

Curriculum Vitae GYULA ERES

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Education

Ph.D. in Chemical Physics, 1985, University of Illinois at Urbana-Champaign

B.S. in Physical Chemistry, 1977, University of Belgrade, Belgrade, Yugoslavia

Professional Experience

Group Leader, Quantum Heterostructures Group, 2020/10-present, Materials Science and Technology Division, Oak Ridge National Laboratory

Senior Research Staff Member, 2019/11-2020, Materials Science and Technology Division, Oak Ridge National Laboratory

Interim Group Leader, Quantum Heterostructures Group, 2019/01-2019/11, Materials Science and Technology Division, Oak Ridge National Laboratory

Senior Research Staff Member, 2004-2019, Materials Science and Technology Division, Oak Ridge National Laboratory

Research Staff Member, 1987–2004, Solid State Division, Oak Ridge National Laboratory

Postdoctoral Research Associate, 1985-1987, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign

Research Interests

My research interests are focused on the atomic surface transport mechanisms and the growth kinetics of epitaxial thin films and nanostructured materials. Nonequilibrium growth environments are used for creating a variety of well-defined initial conditions. The evolution from these states into stable and metastable phases and structures is probed using real-time and post growth characterization methods. The experimental approaches combine surface characterization, surface modification and thin film growth methods such as surface x-ray diffraction, laser based optical diagnostics, reflection high energy electron diffraction, and molecular beam based non-equilibrium and energy-enhanced thin film growth techniques such as pulsed laser deposition and supersonic molecular beam epitaxy.

Professional Activities, Honors, Awards

Organizer, Materials Research Society Spring Meeting, Symposium “Insights for Energy Materials Using *In Situ* Characterization,” 2015, San Francisco, CA

Co-organizer, Materials Research Society Spring Meeting, Symposium “*In Situ* Characterization Methods in Energy Materials Research,” 2013, San Francisco, CA.

Organizer, American Physical Society March Meeting, Focus Session “Carbon Nanotubes and Related Materials,” 2012, Boston, MA.

Co-Organizer, Materials Research Society Spring Meeting, Symposium “Bandgap Engineering and Interfaces of Metal Oxides for Energy,” 2012, San Francisco, CA.

Co-Organizer, Materials Research Society Fall Meeting, Symposium “Real Time Studies of Evolving Thin Films and Interfaces,” 2010, Boston, MA.

Organizer, American Physical Society March Meeting, Tutorial “Forefront Methods and Limits of Lithography,” 2006, Baltimore, MD

Visiting Scientist, Swiss Light Source/ Paul Scherrer Institute (2016/2017)

Battelle, Critical Science and Technology Challenges Award (2002)

ORNL Technical Achievement Award (2000)

DOE DMS Significant Implications for DOE-Related Technologies in Solid State Physics (1993)

ORNL Significant Event Award (1987)

Avery Brundage Scholarship, University of Illinois (1983, 1984)

Publications

Unexpected crystalline homogeneity from the disordered bond network in

La(Cr_{0.2}Mn_{0.2}Fe_{0.2}Co_{0.2}Ni_{0.2})O₃ films, Matthew Brahlek, Alessandro R. Mazza, Krishna Chaitanya Pitike, Elizabeth Skoropata, Jason Lapano, **Gyula Eres**, Valentino Cooper, Zac. T. Ward, *PRM* **4**, 054407 (2020).

Vertically Aligned Single-Crystalline CoFe₂O₄ Nanobrush Architectures with High Magnetization and Tailored Magnetic Anisotropy, Lisha Fan, Xiang Gao, Thomas O. Farmer, Dongkyu Lee, Er-Jia Guo, Sai Mu, Kai Wang, Michael R. Fitzsimmons, M. F. Chisholm, T. Z. Ward, **Gyula Eres**, and Ho Nyung Lee, *Nanomaterials* **10**, 472 (2020).

Growth of metallic delafossite PdCoO₂ by molecular beam epitaxy, Matthew Brahlek, Gaurab Rimal, Jong Mok Ok, Debangshu Mukherjee, Alessandro R. Mazza, Qiyang Lu, Ho Nyung Lee, T. Zac Ward, Raymond R. Unocic, **Gyula Eres**, and Seongshik Oh, *PRM* **3**, 093401 (2019).

Experimental setup combining in situ hard X-ray photoelectron spectroscopy and real-time surface X-ray diffraction for characterizing atomic and electronic structure evolution during complex oxide heterostructure growth, **Gyula Eres**, C. M. Rouleau, Q. Lu, Z. Zhang, E. Benda, H.N. Lee, J.Z. Tischler, D. D. Fong, *RSI* **90**, 093902 (2019).

Competing phases in epitaxial vanadium dioxide at nanoscale, Yogesh Sharma, Martin V. Holt, Nouamane Laanait, Xiang Gao, Ilia N. Ivanov, Liam Collins, Changhee Sohn, Zhaoliang Liao, Elizabeth Skoropata, Sergei V. Kalinin, Nina Balke, **Gyula Eres**, Thomas Z. Ward, and Ho Nyung Lee, *APL Mat* **7**, 081127 (2019).

Strain Tolerance of Two-Dimensional Crystal Growth on Curved Surfaces, Kai Wang, Alexander A. Poretzky, Zhili Hu, Bernadeta R. Srijanto, Xufan Li, Nitant Gupta, Henry Yu, Mengkun Tian,

Masoud Mahjouri-Samani, Xiang Gao, Akinola Oyedele, Christopher M. Rouleau, **Gyula Eres**, Boris I. Yakobson, Mina Yoon, Kai Xiao, David B. Geohegan, *Sci Adv* **5**, eaav4028 (2019).
Recent progress in characterization of the core–shell structure of black titania, Mengkun Tian, Chenze Liu, Jingxuan Ge, D.B. Geohegan, Gerd Duscher, and **Gyula Eres**, *J. Mat Res* **34**, 1138 (2019).

19-Fold thermal conductivity increase of carbon nanotube bundles toward high-end thermal design applications, Yangsu Xie, Tianyu Wang, Bowen Zhu, Chaoyi Yan, Peixin Zhang, Xinwei Wang, **Gyula Eres**, *Carbon* **139**, 445 (2018).

Cooperative Behavior in the Evolution of Alignment and Structure in Vertically Aligned Carbon-Nanotube Arrays Grown using Chemical Vapor Deposition, **Gyula Eres**, C.M. Rouleau, A.A. Puzos, D.B. Geohegan, and H. Wang, (Invited paper) *PRA* **10**, 024010 (2018).

Formation Mechanism, Growth Kinetics, and Stability Limits of Graphene Adlayers in Metal-Catalyzed CVD Growth, Zhu-Jun Wang, Feng Ding, **Gyula Eres**, Markus Antonietti, Robert Schloegl, and Marc Georg Willinger, *Adv. Mater. Interfaces* **5**, 1800255 (2018).

Kinetically Controlled Fabrication of Single-Crystalline TiO₂ Nanobrush Architectures with High Energy {001}, Lisha Fan, Xiang Gao, D. Lee, Er-Jia Guo, S. Lee, P. C. Snijders, T. Z. Ward, **Gyula Eres**, M. F. Chisholm, and Ho Nyung Lee, *Adv. Sci.* 1700045 (2017).

Nonequilibrium Synthesis of TiO₂ Nanoparticle “Building Blocks” for Crystal Growth by Sequential Attachment in Pulsed Laser Deposition, Masoud Mahjouri-Samani, Mengkun Tian, A. A. Puzos, Miaofang Chi, Kai Wang, G. Duscher, C. M. Rouleau, **Gyula Eres**, Mina Yoon, John Lasseter, Kai Xiao, and David B. Geohegan, *Nano Lett.* **17**, 4624 (2017).

Black Anatase Formation by Annealing of Amorphous Nanoparticles and the Role of the Ti₂O₃ Shell in Self-Organized Crystallization by Particle Attachment, Mengkun Tian, M. Mahjouri-Samani, Kai Wang, A. A. Puzos, D. B. Geohegan, W. D. Tennyson, N. Cross, C. M. Rouleau, T. A. Zawodzinski, Jr., G. Duscher & **Gyula Eres**, *ACS Appl. Mater. Interfaces*, **9**, 22018 (2017).

Atomically precise lateral modulation of a two-dimensional electron liquid in anatase TiO₂ thin films, Z. Wang, Z. Zhong, S. McKeown Walker, Z. Ristic, J.-Z. Ma, F. Y. Bruno, S. Riccò, G. Sangiovanni, **Gyula Eres**, N. C. Plumb, L. Patthey, M. Shi, J. Mesot, F. Baumberger and M. Radovic, *Nano Lett.* **17**, 2561 (2017).

Persistent Electrochemical Performance in Epitaxial VO₂(B), Shinbuhm Lee, Xiao-Guang Sun, Andrew A. Lubimtsev, Xiang Gao, Panchapakesan Ganesh, Thomas Z. Ward, **Gyula Eres**, Matthew F. Chisholm, Sheng Dai, and Ho Nyung Lee *Nano Lett.*, **17**, 2229 (2017).

Nonequilibrium Synthesis of Highly Porous Single-Crystalline Oxide Nanostructures, Dongkyu Lee, Xiang Gao, Lisha Fan, Er-Jia Guo, Thomas O. Farmer, William T. Heller, T. Z. Ward, **Gyula Eres**, Michael R. Fitzsimmons, Matthew F. Chisholm, and Ho Nyung Lee, *Adv. Mater. Interfaces*, **4**, 1601034 (2017),

Quantum chemical molecular dynamics simulation of carbon nanotube–graphene fusion, Hu-Jun Qian, **Gyula Eres** & Stephan Irle, *Molecular Simulation*, **43**, 1269 (2017).

Stabilizing Ir(001) Epitaxy on Yttria-Stabilized Zirconia Using a Thin Ir Seed Layer Grown by Pulsed Laser Deposition, Lisha Fan, C. B. Jacobs, C. M. Rouleau, and **Gyula Eres**, *Cryst. Growth Design*, **17**, 89 (2017).

Dynamic Scaling and Island Growth Kinetics in Pulsed Laser Deposition of SrTiO₃, **Gyula Eres**, J.Z. Tischler, C.M. Rouleau, H.M. Christen, P. Zschack, and B.C. Larson, *Phys. Rev. Lett.* **117**, 206102 (2016).

Stacking sequence and interlayer coupling in few-layer graphene revealed by in situ imaging, Zhu-Jun Wang, Jichen Dong, Yi Cui, **Gyula Eres**, Olaf Timpe, Qiang Fu, Feng Ding, R. Schloegl & Marc-Georg Willinger, *Nature Comm.* **7**, 13256 (2016).

Emerging magnetism and anomalous Hall effect in iridate–manganite heterostructures, John Nichols, Xiang Gao, S. Lee, T.L. Meyer, J. W. Freeland, V.Lauter, Di Yi, Jian Liu, D. Haskel, J. R. Petrie, Er-Jia Guo, Andreas Herklotz, Dongkyu Lee, T.Z.Ward, **Gyula Eres**, M.R. Fitzsimmons & Ho Nyung Lee, *Nature Comm.* **7**, 12721 (2016).

Tailoring Vacancies Far Beyond Intrinsic Levels Changes the Carrier Type in Monolayer MoSe_{2-x} Crystals, M. Mahjouri-Samani, L. Liang, A. Oyedele, Yong-Sung Kim, Mengkun Tian, N. Cross, Kai Wang, Ming-Wei Lin, Abdelaziz Boulesbaa, C. M. Rouleau, A. A. Puzos, Kai Xiao, Mina Yoon, **Gyula Eres**, G. Duscher, B. G. Sumpter, and D. B. Geohegan, *Nano Lett.* **16**, 5213 (2016).

Strain Control of Oxygen Vacancies in Epitaxial Strontium Cobaltite Films, Jonathan R. Petrie, Chandrima Mitra, Hyoungjeen Jeon, Woo Seok Choi, Tricia L. Meyer, Fernando A. Reboredo, John W. Freeland, **Gyula Eres**, and Ho Nyung Lee, *Adv. Func. Mat.* **26**, 1564 (2016).

Elevated Gold Ellipse Dimer Arrays with 10 nm Gaps as Effective and Controllable SERS Substrates, Aaron M. Jubb, Yang Jiao, **Gyula Eres**, Scott T. Retterer, and Baohua Gu, *Nanoscale* **8**, 5641 (2016).

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Stoichiometry control of complex oxides by sequential pulsed-laser deposition from binary-oxide targets, A. Herklotz, K. Dörr, T. Z. Ward, **Gyula Eres**, H. M. Christen, and M. D. Biegalski, *Appl. Phys. Lett.* **105**, 131601 (2015).

Digital Transfer Growth of Patterned 2D Metal Chalcogenides by Confined Nanoparticle Evaporations, M. Mahjouri-Samani, M. Tian, K. Wang, Abdelaziz Boulesbaa, C. M. Rouleau, A. A. Puzos, M. A. McGuire, K. Xiao, **Gyula Eres**, G. Duscher, and D. B. Geohegan, *ACS Nano* **8**, 11567 (2014).

Revealing the surface and bulk regimes of isothermal graphene nucleation and growth on Ni with in situ kinetic measurements and modeling, A. A. Puzos, I. A. Merkulov, C. M. Rouleau, **Gyula Eres**, D. B. Geohegan, *Carbon* **79**, 256 (2014).

Pulsed Laser Deposition of Photoresponsive Two-Dimensional GaSe Nanosheet Networks, M. Mahjouri-Samani, Ryan Gresback, Mengkun Tian, Kai Wang, Alexander A. Puzos, Christopher M. Rouleau, **Gyula Eres**, Ilia N. Ivanov, Kai Xiao, Michael A. McGuire, Gerd Duscher, and David B. Geohegan, *Adv. Func. Mat.* **24**, 6365 (2014).

Direct Observation of Resistive Heating at Graphene Wrinkles and Grain Boundaries, Kyle L. Grosse, Vincent E. Dorgan, David Estrada, Joshua D. Wood, Ivan Vlassiuk, **Gyula Eres**, William P. King, and Eric Pop, *Appl. Phys. Lett.* **105**, 143109 (2014).

Cooperative Island Growth of Large-Area Single-Crystal Graphene on Copper Using Chemical Vapor Deposition, **Gyula Eres**, Murari Regmi, Christopher M. Rouleau, Jihua Chen, Ilia N. Ivanov, Alexander A. Puzos, and David B. Geohegan, *ACS Nano* **8**, 5657 (2014).

Quantum Chemical Simulations Reveal Acetylene-Based Growth Mechanisms in the Chemical Vapor Deposition Synthesis of Carbon Nanotubes, Ying Wang, Xingfa Gao, Hu-Jun Qian, Yasuhito Ohta, Xiaona Wu, **Gyula Eres**, Keiji Morokuma, and Stephan Irle, *Carbon* **72**, 22 (2014).

Approaching Carbon Nanotube Reinforcing Limit in B4C Matrix Composites Produced by Chemical Vapor Infiltration, Li, K.Y. Yang, Y.C. Gu, Z.J. Howe, J.Y. **Eres Gyula**, Zhang, L.T. Li, X.D. Pan, Z.W. *Adv. Eng. Mat.* **16**, 161 (2014).

Origins of electronic band gap reduction in Cr/N codoped TiO₂, C. Parks Cheney, P. Vilmercati, E. W. Martin, M. Chiodi, L. Gavioli, M. Regmi, **Gyula Eres**, T. A. Callcott, H. H. Weitering, and N. Mannella, *Phys. Rev. Lett.* **112**, 036404 (2014).

Graphene Nucleation Density on Copper: Fundamental Role of Background Pressure, I. Vlassiuk, S. Smirnov, M. Regmi, S.P. Surwade, N. Srivastava, R. Feenstra, **Gyula Eres**, C. Parish, N. Lavrik, P. Datskos, S. Dai, and P. Fulvio, *J. Phys. Chem. C* **117**, 18919 (2013).

Self-Assembly of Graphene on Carbon Nanotube Surfaces, Kaiyuan Li, **Gyula Eres**, Jane Howe, Yen-Jun Chuang, Xufan Li, Zhanjun Gu, Litong Zhang, Sishen Xie & Zhengwei Pan, *Scientific Reports* **3**, 2353 (2013).

Electrical property measurements of Cr-N codoped TiO₂ epitaxial thin films grown by pulsed laser deposition, J. Jacimovic, R. Gaal, A. Megrez, L. Forro, M. Regmi, and **Gyula Eres**, *Appl. Phys. Lett.* **102**, 172108 (2013).

Real-time optical diagnostics of graphene growth induced by pulsed chemical vapor deposition, A. A. Puzos, D. B. Geohegan, S. Pannala, C. M. Rouleau, M. Regmi, N. Thonnard and **Gyula Eres**, *Nanoscale* **5**, 6507 (2013).

Atomic layer engineering of perovskite oxides for chemically sharp heterointerfaces, Woo Seok Choi, Christopher M. Rouleau, Sung Seok A. Seo, Zhenlin Luo, Hua Zhou, Timothy T. Fister, Jeffrey A. Eastman, Paul H. Fuoss, Dillon D. Fong, Jonathan Z. Tischler, **Gyula Eres**, Matthew F. Chisholm, and Ho Nyung Lee, *Advanced Materials* **24**, 6423 (2012).

Thickness limitations in carbon nanotube reinforced silicon nitride coatings synthesized by vapor infiltration, Abhishek K. Kothari, Brian W. Sheldon, and **Gyula Eres**, *Acta Materialia* **60**, 7104 (2012).

The Effect of Growth Parameters on the Intrinsic Properties of Large-Area Single Layer Graphene Grown by Chemical Vapor Deposition on Cu, Murari Regmi, Matthew F. Chisholm, and **Gyula Eres**, *Carbon* **50**, 134 (2012).

Incremental growth of short SWNT arrays by pulsed chemical vapor deposition, A. A. Puztzky, D. B. Geohegan, J. J. Jackson, S. Pannala, **G. Eres**, C. M. Rouleau, and K. More, *Small* **8**, 1534 (2012).

A narrow biasing window for high density diamond nucleation on Ir/YSZ/Si(100) using microwave plasma chemical vapor deposition, Murari Regmi, K.L. More, and **Gyula Eres**, *Diamond and Related Materials* **23**, 28 (2012).

Flux-Dependent Growth Kinetics and Diameter Selectivity in Single-Wall Carbon Nanotube Arrays, Geohegan, David; Puztzky, Alexander; Jackson, Jeremy; Rouleau, Christopher; **Eres, Gyula**; More, Karren, *ACS Nano* **5**, 8311 (2011).

Comparing Cr, and N only doping with (Cr,N)-codoping for enhancing visible light reactivity of TiO₂, Yuan Li, Wei Wang, Xiaofeng Qiu, Liang Song, Harry M. Meyer III, M. Parans Paranthaman, **Gyula Eres**, Zhenyu Zhang, and Baohua Gu, *Applied Catalysis B-Environmental* **110**, 148 (2011).

Quantitative determination of energy enhanced interlayer transport in pulsed laser deposition of SrTiO₃, **Gyula Eres**, J. Z. Tischler, C. M. Rouleau, Paul Zschack, H.M. Christen and B.C. Larson, *Phys. Rev. B* **84**, 195467 (2011).

Role of Hydrogen in Chemical Vapor Deposition Growth of Large Single-Crystal Graphene, Ivan Vlassioug, Murari Regmi, Pasquale Fulvio, Sheng Dai, Panos Datskos, **Gyula Eres**, and Sergei Smirnov, *ACS Nano* **5**, 6069 (2011).

Aligned carbon nanotube-reinforced silicon carbide composites produced by chemical vapor infiltration, Gu Zhanjun, Yang Yingchao, Li Kaiyuan, Xinyong Tao, **Gyula Eres**, Jane Y. Howe, Litong Zhang, Xiaodong Li, Zhengwei Pan, *Carbon*, **49**, 2475 (2011).

Thermophysical properties of multi-wall carbon nanotube bundles at elevated temperatures up to 830 K, Xiaopeng Huang, Jianmei Wang, **Gyula Eres**, Xinwei Wang, *Carbon*, **49**, 1680 (2011).

An integrated portable Raman sensor with nanofabricated gold bowtie array substrates for energetics detection, Nahla A. Hatab, C.M. Rouleau, S.T. Retterer, **Gyula Eres**, P.B. Hatzinger, and Baohua Gu, *Analyst*, **136**, 1697 (2011).

Real-Time Studies of Pulsed Laser Deposition Using Surface X-ray Diffraction in In-situ characterisation of thin film growth, **Gyula Eres**, J.Z. Tischler, C.M. Rouleau, Paul Zschack, B.C. Larson, H.M. Christen, editors Gertjan Koster and Guus Rijnders, Woodhead Publishing, Oxford, 2011.

Pulsed Growth of Vertically Aligned Nanotube Arrays with Variable Density, J.J. Jackson, A.A. Puztzky, K.L. More, C.M. Rouleau, **Gyula Eres**, and D.B. Geohegan, *ACS Nano* **4**, 7573 (2010).

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Detection and Analysis of Cyclotrimethylenetrinitramine (RDX) in Environmental Samples by Surface Enhanced Raman Spectroscopy, Nahla A. Hatab, **Gyula Eres**, Paul B. Hatzinger, and B. Gu, *J. Raman Spectrosc.* **41**, 1131 (2010).

Ab initio study on noncompensated CrO codoping of GaN for enhanced solar energy conversion, H. Pan, B. Gu, **Gyula Eres**, and Z. Zhang, *J. Chem. Phys.* **132**, 104501 (2010).

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Altering the catalytic activity of thin metal catalyst films for controlled growth of chemical vapor deposited vertically aligned carbon nanotube arrays, Rouleau, C. M. **Eres**, G. Cui, H. Christen, H. M. Puretzky, A. A. Geohegan, D. B. *Appl. Phys. A* **93**, 1005 (2008).

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Real-Time Imaging of Vertically Aligned Carbon Nanotube Array Growth Kinetics, A.A. Puretzky **Gyula Eres**, C.M. Rouleau, I. Ivanov, and D.B. Geohegan, *Nanotechnology* **19**, 055605 (2008).

In Situ Time-Resolved Measurements of Carbon Nanotube and Nanohorn Growth, D.B. Geohegan, A.A. Poretzky, D. Styers-Barnett, H. Hu, B. Zhao, H. Cui, C.M. Rouleau, **Gyula Eres**, J.J. Jackson, R.F. Wood, S. Pannala, and J.C. Wells, *Phys. Stat. Solidi B* **244**, 3944, (2008).

Development of Pulsed Laser-Assisted Thermal Relaxation Technique for Thermal Characterization of Microscale Wires, J.Q. Guo, X.W. Wang, D.B. Geohegan, **Gyula Eres**, and C. Vincent, *J. Appl. Phys.* **103**, 113505 (2008).

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The Control of Electron Transport Related Defects in In Situ Fabricated Carbon Nanotube Device, Z.X. Zhou, R. Jin, **G. Eres**, A. Subedi, and D. Mandrus, *Appl. Phys. Lett.* **89**, 133124 (2006).

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Pyrolytic and Laser Photolytic Growth of Crystalline and Amorphous Germanium Films from Digermane (Ge_2H_6), **Djula Eres**, D.H. Lowndes, J.Z. Tischler, J.W. Sharp, D.B. Geohegan, and S.J. Pennycook, *Mat. Res. Soc. Symp. Proc.* **131**, 517 (1989).

Low Temperature Photon-Controlled Growth of Thin Films and Multilayered Structures, D.H. Lowndes, D.B. Geohegan, **D. Eres**, S.J. Pennycook, D.N. Mashburn, and G.E. Jellison, Jr., *Appl. Surf. Sci.* **36**, 59 (1989).

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Pulsed Laser Deposition of Thin Superconducting Films on $HoBa_2Cu_3O_{7-x}$ and $YBa_2Cu_3O_{7-x}$, D.B. Geohegan, D.N. Mashburn, R.J. Culbertson, S.J. Pennycook, J.D. Budai, R.E. Valiga, B.C. Sales, D.H. Lowndes, L.A. Boatner, E. Sonder, **D. Eres**, D.K. Christen, and W.H. Christie, *J. Mater. Res.* **3**, 1169 (1988).

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Time-Resolved Spectroscopic Studies of the Ultraviolet-Laser Photolysis of Al Alkyls for Film Growth, **D. Eres**, T. Motooka, S. Gorbatkin, D. Lubben, and J.E. Greene, *J. Vac. Sci. Technol. B*, **5**, 848 (1987).

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Photodissociation of Cyanogen: Angle and Velocity Distributions of State Resolved Fragments, **Djula Eres**, M. Gurnick, and J.D. McDonald, *J. Chem. Phys.* **81**, 5552 (1984).

Mass Spectrometric Study of the Ionization and Fragmentation of Carbon Disulphide by Monoenergetic Electron Impact, Miodrag Miletic, **D. Eres**, Miomir Veljkovic, and Kiro F. Zmbov, *Int. J. Mass Spectrom. Ion Phys.* **35**, 231 (1980).

Invited Talks: Conferences and Workshops

SFKM

Real-Time Study of Oxygen Vacancy Ordering Dynamics at Complex Oxide Heterostructure Interfaces, 20th Symposium on Condensed Matter Physics, SFKM 2019, Belgrade, Serbia, October 7-11, 2019

Chemistry Before Crystallization: the Role of Prenucleation Clusters in Formation of Order Within Disorder, From Solid State to Biophysics IX, Cavtat, Croatia, June 16-23, 2018

Dynamics of Materials Synthesis on the Fundamental Building Block Level, YUCOMAT 2017, Herceg Novi, Montenegro, September 4-8, 2017

How PLD Works, 21st American Conference on Crystal Growth and Epitaxy, Santa Fe, NM, July 30 - August 4, 2017

Dynamics of Materials Synthesis on Elementary Building Block Level, CHEX Workshop, APS/ANL Argonne, April 24, 2017

Cooperative Mechanisms in Large-Area Single-Crystal Graphene Growth, From Solid State to Biophysics VIII, Cavtat, Croatia, June 4-11, 2016

Cooperative Mechanisms in Large-Area Single-Crystal Graphene Growth, Graphene and Related Materials, GM-2016, Paestum, Italy, May 23-27, 2016

Dynamics of Materials Synthesis on the Elementary Building Block Level, APS/CNM User Meeting, Argonne, IL, May 9-12 2016

Cooperative Mechanisms in Large-Area Single-Crystal Graphene Growth, EMN Conference, Dubrovnik, Croatia, May 4-7, 2016

Fundamental Building Blocks in Nanomaterial Synthesis, From Hard to Soft Matter ... and Back, Laszlo Forro 60th at EPFL, Lausanne, Switzerland, December 4-6, 2015

Fundamental Building Blocks in Nanomaterial Synthesis, SFKM 2015, Belgrade, Serbia, September 7-11, 2015

The Role of Cooperativity in Two-Dimensional Crystal Growth, YUCOMAT 2015, Herceg Novi, Montenegro, August 31 – September 4, 2015

The Kinetics of Large-Area Single-Crystal Graphene CVD, Guadalupe Workshop on Single Wall Carbon Nanotube Growth Mechanisms VII, Guadalupe, TX, April 10-14, 2015

Novel mechanisms for complex oxide film growth revealed by real-time surface x-ray diffraction performed during pulsed laser deposition, Workshop on Spectroscopy of Novel Materials, Saas-Grund, Switzerland, January 23-27, 2015

How Much Do We Really Understand How Pulsed Laser Deposition Works? Fall MRS 2014, Boston, MA, November 30-December 5, 2014

Controlling the nucleation density for large area single-crystal graphene growth by CVD on Cu, International Conference on Diamond and Carbon Materials, Madrid, Spain, 8-11 September 2014

What can we learn from cooperative behavior in 2D crystal growth? From Solid State to Biophysics VII, Cavtat, Croatia, June 7-14, 2014

Bandgap Narrowing of Titanium Oxide Semiconductors by Non-Compensated Anion-Cation Codoping for Enhanced Visible Light Photoactivity, Nano Giga Challenges, Phoenix, AZ, March 10-14, 2014

Fundamental Limits of Interface Sharpness in Complex Oxides Film Growth, ESMF6, Wittenberg, Germany, July 20-26 2013

How PLD Works: Multiple Time Scales and Multiple Length Scales in PLD Growth Kinetics Studied by Time-Resolved Surface X-Ray Diffraction, Materials Synthesis by Design Workshop, Argonne National Laboratory, May 21-23, 2013

Elementary Building Blocks of Carbon Nanomaterials, Nano Giga Challenges 2011, Moscow-Zelenograd, Russia, September 11-16, 2011

Bandgap Narrowing of Titanium Oxide Semiconductors by Non-Compensated Anion-Cation Codoping for Enhanced Visible Light Photoactivity, SFKM, Belgrade, Serbia, April 18-22, 2011

Bandgap Narrowing of Titanium Oxide Semiconductors by Non-Compensated Anion-Cation Codoping for Enhanced Visible Light Photoactivity, 3rd CMCSN Meeting, UT Dallas, January 20-22, 2011

Nucleation and Early Stages of Diamond Film Growth on Heteroepitaxial Substrates, Diamond 2010, Budapest, Hungary, September 5-9, 2010

Not All Carbon Nanotubes Are Created Equal, Nano Giga Challenges, Hamilton, Ontario, August 10-14, 2009

A Kinetic Model for Self-Assembly of Carbon Nanotubes from Acetylene, NASA/Rice Single Wall Carbon Nanotube Growth Mechanisms Workshop, April 17-20, 2009

Real-Time Studies of Epitaxial Oxide Growth Using Surface X-Ray Diffraction, NSLS/CFN Users Meeting, BNL, Upton NY, May 19-21 2008

The mechanism of pulsed laser deposition of epitaxial oxide films studied by time-resolved surface X-ray diffraction, 2008 Annual Meeting, New Orleans, LA, March 9-13, 2008

Transient Interlayer Transport in SrTiO₃ Pulsed Laser Deposition Studied by Time-Resolved Surface X-Ray Diffraction, XVII Symposium on Condensed Matter Physics, SFKM 2007, Vrsac, Serbia, September 16-20, 2007

Real-Time Studies of the Kinetics of Vertically Aligned Nanotube Growth, NanoteC07, University of Sussex, Brighton, August 29-September 1, 2007

Real-Time Study of Nucleation and Growth of Vertically Aligned Single Wall Carbon Nanotube Arrays, NASA/Rice Nucleation and Growth Workshop III at Canyon of the Eagles Lodge, April 15-19, 2007

Growth Kinetics and the Structure-Property Relationship in Carbon Nanotubes, Motorola Labs Workshop Tempe, AZ May 23, 2006

Study of Nonequilibrium Processes in Pulsed Laser Deposition of Complex Oxides Using Surface X-Ray diffraction, Workshop on In-Situ Characterization of Surface and Interface Structures and Processes, APS/ANL, September 8-9, 2005

Supersonic Molecular Jet Epitaxy: Thin Film Growth Using Hyperthermal Kinetic Energy Neutral Molecules, International Conference on Metallurgical Coatings and Thin Films, San Diego, April 10-14, 2000

Nanofabrication by Direct Epitaxial Growth, Micro and Nano Engineering Conference, Athens, September 15-18, 1997

Semiconductor Thin Film Growth Using Supersonic Molecular Beams, APS 96 March Meeting, Saint Louis, March 20-24, 1996

A Kinetic Perspective of Supersonic Free Jet Epitaxy, Workshop on Selected Energy Epitaxy, JPL, Pasadena, January 29-30, 1996

High Speed Epitaxy Using Supersonic Molecular Beams, Surface Chemistry and Beam-Solid Interactions, MRS Fall Meeting, Boston, MA, November 26 – December 1 1990

Invited Talks: Seminars

Probing the Structure-Property Relationship in Complex Oxide Film Growth Using In Situ Synchrotron X-Ray Measurements, APS User Science Seminar, Argonne IL, August 17, 2018

The Dynamics of Interfacial Thickness Phenomena in Complex Oxide Thin Film Growth, ALS LBNL, Berkeley CA, May 2, 2018

Cooperative Dynamics in Homoepitaxial Pulsed Laser Deposition of SrTiO₃(100), ANL MSD, Argonne IL, December 4, 2017

Thickness Dependent Island Growth Dynamics in Pulsed Laser Deposition of SrTiO₃ Revealed by Real-Time Diffuse Surface X-ray Diffraction, BNL NSLS-II, Upton NY, January 19, 2017

Dynamics of Materials Synthesis on the Fundamental Building Block Level, Princeton Plasma Physics Laboratory, Princeton, NJ, January 18, 2017

Dynamic Scaling, Quasi Step Flow and the Mechanism of Surface Smoothing in Pulsed Laser Deposition, University of Naples, Naples, Italy, May 27, 2016

The Kinetics of Large-Area Single-Crystal Graphene CVD, Pop Lab Stanford, Stanford, CA, December 18, 2015

How Much Do We Really Understand How Pulsed Laser Deposition Works? Helmholtz-Zentrum Berlin, October 7, 2015

Real-Time Access of Functionality in Epitaxial Complex Oxides, ORNL-ANL Virtual Seminars on Functional Oxides, February 12, 2015

Novel mechanisms for complex oxide film growth revealed by real-time surface x-ray diffraction performed during pulsed laser deposition, Surface Interface Scattering Lunch Seminar, APS, Argonne, IL, December 9, 2014

Bandgap Narrowing of Titanium Oxide Semiconductors by Non-Compensated Anion-Cation Codoping for Enhanced Visible Light Photoactivity, ICMAB-CSIC, Barcelona, September 5, 2014

Kinetic Mechanisms of Large-Area Single-Crystal Graphene Growth, Fritz Haber Institute of the Max Planck Society, Berlin, August 28, 2014

Molecular Structure Transformations and the Kinetics of Carbon Nanomaterial Formation, Department of Mechanical Engineering, NUS, Singapore, September 26, 2013

Molecular Structure Transformations and the Kinetics of Carbon Nanomaterial Formation, Begbroke Science Forum, Oxford University, Oxford, September 19, 2013

Fundamental Limits of Interface Sharpness in Complex Oxide Film Growth, Magnet Lab, FSU, Tallahassee, FL, June 4, 2013

Non-Compensated Anion-Cation Codoping of TiO_2 for Enhanced Solar Energy Conversion, EPFL, Lausanne, Switzerland, May 21, 2012

Molecular Structure Transformations and the Kinetics of Carbon Nanomaterial Formation, University of Illinois at Urbana-Champaign, September 30, 2011

Probing the Mysteries of Pulsed Laser Deposition by Time-Resolved Surface X-Ray Diffraction, APS User Science Seminar, APS/ANL Argonne, IL, June 10, 2011

Nucleation and Early Stages of Diamond Film Growth on Heteroepitaxial Substrates, Naval Research Laboratory, Washington, DC, November 16, 2010

Probing the Mysteries of Pulsed Laser Deposition, ORNL MSTD Lunch Seminar, Oak Ridge, TN June 17, 2009

The role of chemical structure in rapid growth of vertically aligned nanotube arrays, MIT, Boston, MA, December 4, 2008

Growth Related Kinetic Effects in Vertically Aligned Nanotube Array Properties, Boston University, Boston, MA, December 3, 2008

Growth Kinetics and the Structure-Property Relationship in Carbon Nanotubes, Ecole Centrale Paris, June 27, 2008

Growth Related Kinetic Effects in Vertically Aligned Nanotube Array Properties, Laboratoire de Physique des Solides, LPS Orsay, June 24 2008

The Study of Atomic Surface Transport Processes in Layer-by-Layer Growth Using Time-Resolved Surface X-Ray Diffraction, Condensed Matter Physics, BNL, Upton, NY, May 20, 2008

Growth Kinetics and the Structure-Property Relationship in Vertically Aligned Carbon Nanotube Arrays, Institute of Physics, Zemun, Serbia, September 23, 2007

Interlayer Transport in Pulsed Laser Deposition Studied by Time-Resolved Surface X-Ray Diffraction, UNI-CAT Lunch Seminar, APS, Argonne, IL, September 13, 2007

Real-Time Studies of the Kinetics of Vertically Aligned Nanotube Growth, University of Cambridge, Cambridge, August 31, 2007

Interlayer Transport in Complex Oxide Film Growth during Pulsed Laser Deposition, Cornell University, October 18, 2002

Semiconductor Thin Film Growth Using Supersonic Molecular Beams, Ohio University, April 23, 1997

Semiconductor Thin Film Growth Using Supersonic Molecular Beams, Cornell University, May 17, 1995

Patents

“Method and Apparatus for Growing Films on Substrates Using Pulsed Supersonic Jets,” U.S. Patent No. 5,164,040, Issued: 11-17-92.

“Method of Digital Epitaxy by Externally Controlled Closed-Loop Feedback,” U.S. Patent No. 5,330,610, Issued: 7-19-94.

“Apparatus for Externally Controlled Closed-Loop Feedback Digital Epitaxy,” U.S. Patent No. 5,540,783, Issued: 7-30-96.

“Catalysis-Induced Growth of Carbon Nanotubes on Tips of Cantilevers and Nanowires,” U.S. Patent No. 6,755,956, Issued: 6-29-2004.

“Molecular Jet Growth of Carbon Nanotubes and Dense Vertically Aligned Nanotube Arrays” U.S. Patent No. 7,811,632, Issued: October 12, 2010

Projects Funded

Gyula Eres, PI, Seed Money, Title: Controlling the Growth and Stacking of Two-Dimensional Materials by Pulsed Laser Epitaxy (2018-2019).

Gyula Eres, PI, LDRD, Title: Heteroepitaxial Diamond Films for Next Generation Power Electronics (2013-2014).

Gyula Eres, Co-PI, ESTCP, Title: Demonstration and Validation of a Portable Raman Sensor for *In-Situ* Detection and Monitoring of Energetics (2012-2014).

Gyula Eres, Co-PI, Seed Money, Title: Growth of Large Area Single Crystal Graphene (2011-2012).

Gyula Eres, PI, Seed Money, Title: Synthesis of Ultrastrong Three Dimensional Networks from sp^2 Carbon Using Low-Energy Molecular Transformation (2010-2011).

Gyula Eres, Co-PI, Seed Money, Title: Probing Photovoltaic Processes at the Single Interface Level (2010-2011).

Gyula Eres, Co-PI, LDRD, Title: Active Control of Surface Plasmonics with Ferroelectricity (2008-2011).

Gyula Eres, PI, OE, Diamond Growth for Power Electronic Devices (2008-2012).

Gyula Eres, Co-PI, Seed Money, Title: Tip Enhanced Optical Assembly of Plasmonic Nanostructures (2008-2009).

Gyula Eres, Co-PI, LDRD, Title: Nanostructured Thermoelectrics for Power Generation: Smaller is Cooler (2007-2010).

Gyula Eres, Co-PI, Seed Money, Title: Deterministic Growth of Oxide Nanostructures by Pulsed-Laser Deposition (2007-2008).

Gyula Eres, Co-PI, LDRD, Title: Bandgap Narrowing of Oxide Semiconductors Using Non-Compensated n-p Co-Doping for Enhanced Solar Energy Utilization (2007-2010).

Gyula Eres Co-PI, SERDEP, Title: A Portable Fiberoptic Surface Enhanced Raman Sensor for Detection and Monitoring of Perchlorate and Energetics (2007-2010).

Gyula Eres, Co-PI, Seed Money, Title: Scalable Surface Enhanced Raman Spectroscopy (SSERS) for Single Molecule Detection and Characterization (2005-2006).

Gyula Eres, Co-PI, LDRD, Title: Probing the Boundary between Imaging Microscopy and Spectroscopy: Toward the Exploration of Single Particles by Nuclear Magnetic Resonance Spectroscopy (2005-2008).

Gyula Eres, PI, Seed Money, Title: Selective Area Chemical Vapor Deposition of Carbon Nanotube Films Using Seeded Molecular Beams (2003-2004).

Gyula Eres, Co-PI, LDRD, Title: Nanorods for Energy and Photonics (2003-2006).

Gyula Eres, PI, Seed Money, Title: Ultra-Low Energy Resistless Electron Beam Nanolithography (2001-2002).

Gyula Eres, PI, DARPA, Title: Fabrication of Ultra High Resolution Thin Film Structures by Direct Epitaxial Growth (1997-2000).

Gyula Eres, Co-PI, Seed Money, Title: Growth and Analysis of Amorphous Silicon Nitride Films (1997-1998).

Gyula Eres, PI, Seed Money, Title: Thin Film Growth of Wide Bandgap Refractory Semiconductors (1996-1997).

Gyula Eres, PI, LDRD, Title: Quantum Size Effects in Artificially Structured Semiconductors: Fabrication and Properties of Novel Mesoscopic Structures (1993-1996).

Djula Eres, PI, Seed Money, Title: Investigation of the Role of Molecule-Surface Collision Energy in Thin-Film Growth (1990-1991).

Graduate and Postdoctoral Advisors

Ph.D. (1985) with Prof. J. Douglas McDonald, U. of Illinois at Urbana-Champaign

Postdoctoral Associate (1985-1987) with Prof. Joseph E. Greene, U. of Illinois at Urbana-Champaign

Thesis Advisees

J. W. Sharp (1989-1994 physics, Tennessee-Knoxville)

Postgraduate-Scholars Sponsored (some shared)

Wenrui Zhang (2019-2020, came from BNL)

Lisha Fan (2015-2018 came from U. of Nebraska)

Yang Zhang (2012-2013 came from Vanderbilt University)

Murari Regmi (2009-2012 came from Michigan State University)

Hui Pan (2008-2009 came from National University of Singapore)

Abu Hatab Nahla (2007-2010 came from the University of Tennessee)

Qiu Xiaofeng (2007-2009 came from Case Western Reserve University)

Zhixian Zhou (2005-2008 came from Florida State University)

Hongtao Cui (2001-2004 came from U. of North Carolina-Chapel Hill)

Yayi Y. Wei (1999-2003 came from Max Planck Institute, Stuttgart, Germany))

Gyu-chul Yi (1997-1999 came from Northwestern U.)

Frank Hui (1996-1999 came from Ohio State University)

Lung Han Peng (1994-1995 came from Harvard University)