

## Kumar Varoon Agrawal

(Formerly Kumar Varoon)

765 Somerville Ave., Apt 21  
Somerville, MA 02143, USA

Email: varoon@mit.edu  
Phone: +16126153300

### Education

PhD (Chemical Engineering), University of Minnesota, Minneapolis, MN, USA 2008-2013  
Advisors: Prof. Michael Tsapatsis, Prof. Lorraine F. Francis  
Thesis: Dispersible exfoliated zeolite nanosheets and their application in high performance zeolite membranes

B. Tech. (Chemical Engineering), IIT Bombay, Mumbai, India 2001-2005  
Advisor: Prof. Jayesh Bellare  
Thesis: Investigation of nanostructure in hydroxyapatite during synthesis of nanoporous hydroxyapatite granules for drug delivery application

### Professional Experience

Postdoctoral Research Assistant, Chemical Engineering, MIT June 2014 – Present  
Advisor: Prof. Michael S. Strano  
Project 1: Functionalization of graphene for application in membrane reactor.  
Project 2: Investigation of phase change of water inside carbon nanotubes

Postdoctoral Research Assistant, Chemical Engineering, University of Minnesota Nov 2013- June 2014  
Advisor: Prof. Michael Tsapatsis  
Project 1: Characterization of separation behavior of MFI membranes under industrial conditions.  
Project 2: Synthesis of high performance membrane support

Engineer (Global Hair Care R&D), Procter & Gamble, Kobe, Japan 2005-2008  
Job Responsibility: Design of shampoos and conditions to improve the overall hair quality

- Engineered tools based on heat transfer and static charge dissipation to measure hair damage

### Publications

1. K. V. Agrawal, B. Topuz, T. C. T. Pham, T. H. Nyugen, N. Sauer, N. Rangnekar, H. Zhang, K. Narasimharao, S. Basahel, L. F. Francis, C. W. Macosko, S. Al-Thabaiti, M. Tsapatsis, K. B. Yoon “Oriented MFI membranes by gel-less secondary growth of 50nm-thick MFI-nanosheet seed layers”, To be submitted, November 2014 (the draft can be shared).
2. N. Rangnekar, M. Shete, K. V. Agrawal, B. Topuz, P. Kumar, K. Narasimharao, I. Ismail, A. Alyoubi, S. Basahel, L. F. Francis, C. W. Macosko, K. A. Mkhoyan, B. Stottrup, S. Al-Thabaiti, M. Tsapatsis, “2D zeolite coatings: Langmuir trough deposition of 3.0 nm-thick MFI zeolite nanosheets”, to be submitted, October 2014 (the draft can be shared).
3. K. V. Agrawal, B. Topuz, M. Navarro, Z. Jiang, K. Nguenkam, B. Elyassi, L. F. Francis, M. Tsapatsis, “Solution-processable exfoliated zeolite nanosheets purified by density gradient centrifugation”, **AICHe J.**, 59, 3458, 2013
  - Invited article in the special issue of AICHe J. Founders Tribute to Neal R. Amundson.
4. K. Varoon, X. Zhang, B. Elyassi, D. D. Brewer, M. Gettel, S. Kumar, J. A. Lee, S. Maheshwari, A. Mittal, C. Y. Sung, M. Cococcioni, L. F. Francis, A. V. McCormick, K. A. Mkhoyan, M. Tsapatsis, “Dispersible Exfoliated Zeolite Nanosheets and Their Application as a Selective Membrane”, **Science**, 334, 72, 2011.
  - Among breakthroughs of 2011, selected by the editors of the Science magazine.

5. X. Zhang, D. Liu, D. Xu, S. Asahina, K. Cychosz, K. V. Agrawal, Y. Al Wahedi, A. Bhan, S. Al Hashimi, O. Terasaki, M. Thommes, M. Tsapatsis, "Direct Synthesis of a Self-Pillared Single Unit Cell Zeolite", **Science**, 336, 1684, 2012.
6. H. Zhang, W. J. Suszynski, K. V. Agrawal, M. Tsapatsis, S. Al Hashimi, L. F. Francis, "Coating of Open Celled Foams", **Ind. Eng. Chem. Res.**, 51, 9250, 2012.
7. J. A. Stoeger, M. Palomino, K. V. Agrawal, X. Zhang, G. N. Karanikolos, A. Corma, M. Tsapatsis, "Oriented CoSAPO-5 Membranes by Microwave-Enhanced Growth on TiO<sub>2</sub>-Coated Porous Alumina", **Angew. Chem. Int. Ed.**, 51, 2470, 2012.
8. K. Kahali, K. Varoon, J. Bellare, "Preparation of Lacey Polymer Film as Efficient Specimen supports for TEM and Cryo-Transmission Electron Microscope (Cryo-TEM)", Proceedings of XXVII Annual Meeting of EMSI and Conference on Electron Microscopy and Allied Fields, April 1-3, 2004, p150-151.

### Patents

1. "Silica Support Structure for a Zeolite Membrane", M. Tsapatsis, K. V. Agrawal, L. F. Francis, U.S. Patent Application 14327720, (2014).
2. "Zeolite Nanosheet Membrane", M. Tsapatsis, K. V. Agrawal, U.S. Patent Application 14130589, (2012).
3. "Method for Assessment of Friction Properties of Fibers or Substrates upon Mechanical Treatment", C. K. Yagnik, K. Varoon, U.S. Patent 20100049671, (2010).
4. "Method for Assessment of Electrostatic Properties of Fibers or Substrates", K. Varoon, U.S. Patent 20090195253, (2010).

### Presentations

1. K. V. Agrawal, B. Topuz, L. F. Francis, M. Tsapatsis, "Purification of MFI-Nanosheets by Density Gradient Centrifugation and Their Application as Ultrathin Membranes", presented at the **17<sup>th</sup> Internation Zeolite Conference** (2013), Moscow, Russia.
2. K. V. Agrawal, B. Topuz, M. Navarro, Z. Jiang, K. Nguenkam, L. F. Francis, M. Tsapatsis, "Solution-Processable Exfoliated Zeolite Nanosheets Purified by Density Gradient Centrifugation", presented at the **6<sup>th</sup> Internation Zeolite Membrane Meeting** (2013), Jeju island, Korea. (poster presentation)
3. K. V. Agrawal, X. Zhang, L. F. Francis, M. Tsapatsis, "Fabrication of Thin Zeolite Membranes Using Exfoliated Zeolite Nanosheets", presented at the 2012 **Euromembrane** meeting, London, UK.
4. K. V. Agrawal, L. F. Francis, M. Tsapatsis, "Ultrathin Coatings of Exfoliated Zeolite Nanosheets on Porous and Non-Porous Supports", presented at the 2012 **International Society of Coating Science and Technology** (ISCST) meeting, Atlanta, GA.
5. K. V. Agrawal, B. Topuz, M. Navarro, Z. Jiang, L. F. Francis, M. Tsapatsis, "Purification of Zeolite Nanosheets by Density Gradient Centrifugation and Sub-100 nm Thin Zeolite Film", presented at the 2012 **AICHE annual meeting**, Pittsburgh, PA.
6. K. Varoon, X. Zhang, B. Elyassi, L. F. Francis, M. Tsapatsis, "Dispersible Exfoliated Zeolite Nanosheets and Their Application as Membrane", presented at the 2011 **AICHE annual meeting**, Minneapolis, MN.
7. K. Varoon, C. Lew, X. Zhang, B. Elyassi, M. Tsapatsis, "Zeolite Thin Films Prepared From Exfoliated MWW and MFI Nanosheets", presented at the 2011 **AICHE annual meeting**, Minneapolis, MN.
8. K. Varoon, X. Zhang, B. Elyassi, D. D. Brewer, M. Gettel, S. Kumar, J. A. Lee, S. Maheshwari, L. F. Francis, M. Tsapatsis, "Dispersible Exfoliated Zeolite Nanosheets and Their Application as Membrane", presented at the 2010 **Gordon Research Conference** on Nanoporous Materials & Their Application, Holderness, NH. (poster presentation)

9. K. Varoon, L. F. Francis, M. Tsapatsis, “Self Assembly of Zeolite Nanoplatelets by Dip Coating”, presented at the 2010 **International Society of Coating Science and Technology (ISCST)** Annual Meeting, Minneapolis, MN. (poster presentation)
10. K. Varoon., K. Kahali, J. Bellare, “Preparation of Lacey Polymer Film as Efficient Specimen Supports for TEM and cryo-Transmission Electron Microscope (cryo-TEM)”, presented at the 2004 annual meeting of **Electron Microscopy Society of India**, New Delhi, India.

### Awards and Honors

1. 2013 AIChE Separations Division **Graduate Student Research Award**.
2. **Doctoral Dissertation Fellowship (DDF)** (2012-2013), University of Minnesota.
3. **Sigma Xi Award** for best student poster presentation during DDF showcase.
4. **CEMS Outstanding Teaching Assistant Award** (2009-2010) for excellent performance as a Teaching Assistant for an undergraduate course (CHEN 2001) at University of Minnesota.
5. Procter & Gamble R&D Vice President **Power of You Gold Award** for outstanding rheology model for Rejoice/Pert shampoo to drive consumer acceptance.
6. **Institute Silver Medal** for graduating with **1<sup>st</sup> rank** in Department of Chemical Engineering at IIT Bombay.
7. **Manudhane Best Undergraduate Student Award** for graduating with excellence in academia as well as extracurricular activities at IIT Bombay.
8. **IIT Bombay Merit Scholarship** for excellence in academia.

### Reviewer

Microporous and Mesoporous Materials, Chemical Engineering Science, Journal of Membrane Science (~12 reviews per year)