Nano and Meso- Control to Advance Polymeric Materials for Membrane Separation

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The Sivaniah group manipulates materials with synthetic and biological approaches whilst seeking to establish a viable interface between the two.

On example is the controlled generation of spatially variant stiffness in 2D gels to interrogate cell mechanotaxis (*Adv. Mater.* 2012). Moreover our group studies the generation of bioplastics using bacterial and enzymatic tools (*Adv. Mater.*, 2013). Through such works, we will develop practical principles that can support our vision of generating industrially relevant processes via bionanotechnology.

Although soft-matter bionanotechnology forms one key part of our research, we mix both synthetic and biosynthetic materials development (with a current focus in achieving energy efficiency and environmental targets in separation technology). Examples include a transformative platform technology for generating nanoporous materials (*Nature Materials* 2012) and high performance microporous membranes for separation of important environmental gases (Nature Commun. (2013, 2014)). In this presentation, we will discuss the science behind the materials used in developing such applications.

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Education & Professional Career:

2013-present Associate Professor, Kyoto University
2008-2013 Research Group Leader, Cambridge University
2006-2008 Lecturer, Leeds University
2004-2008 Asst. Professor, Texas University
2000-2004 JSPS Research Fellow, Kyoto University
1998-2000 PDRA, UC Santa Barbara
1993-1998 PhD, Cambridge University
1989-1993 MEng, Chemical Engineering, Imperial College.

Research Interests:

Material Transport in porous media, Cell Materials Interactions.

Selected Publications:

- Song, Q., Cao, S., Pritchard R., Terentjev, E., Al-Muhtaseb S.A., Cheetham A.K., Sivaniah E.*. Controlled thermal oxidative crosslinking of polymers of intrinsic microporsity for tunable molecular sieve memrbanes, *Nature Communications. 5,* Article number: 4813 (2014)
- Perera, D.H.N., Nataraj, S.K., Thomson, N.M., Sepe, A., Hüttner, S., Steiner, U., Qiblawey, H., Sivaniah, E*. Room-temperature development of thin film composite reverse osmosis membranes from cellulose acetate with antibacterial properties. *Journal of Membrane Science* p. 212 (2014).
- Song, Q., Cao, C., Lu, L., Zavala-Rivera, P., Li, W., Shuai, Z., Cheetham A.K., Al-Muhtaseb S.A., Sivaniah E.*. Photo-oxidative enhancement of polymeric molecular sieve membranes*. Nature Communications.* 4, Article number: 1918 (2013).
- Song, Q., Nataraj, S.K., Roussenova, M.V., Tan, J.C., Hughes, D.J., Li, W., Bourgoin, P., Alam, A., Cheetham A.K., Al-Muhtaseb S.A., Sivaniah E.*. 'Zeolitic imidazolate framework (ZIF-8) based polymer nanocomposite membranes for gas separation.' *Energy and Environmental Science* 5, p.8359 (2012*).*
- P. Zavala-Rivera, K. Channon, V. Nyugen, Nataraj S.K., Kabra D., Friend R.H. and Al-Muhtaseb S.A*.,* Hexemer, A., Calvo, M.E., Miguez, M., Sivaniah, E.*, 'Collective osmotic shock in ordered materials', *Nature Materials* 11, p.53 (2012*).*