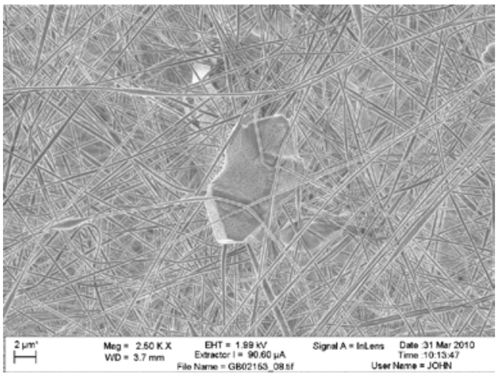
Saving Lives with Chemical Engineering

Supervisors: Prof. Mark Biggs in collaboration with a team in DSTO, Melbourne.
Nature of work: Mesoscale modelling of fluid flow & mass transfer in nanoporous fibre networks
Area: Leading edge of nanotechnology.
Potential implications: Better filters for protecting individuals and groups from toxic gases.
Funding: Stipend is already available (via joint funding from DSTO and Adelaide Airport) and the fees will be covered automatically for Australian/NZ citizens and those with PR. Those who do not fall within these categories could have their fees waived if their GPA is sufficiently high.



Brief description: Filters based on nanoporous carbon materials (powder or cloth) have long been used to protect individuals, vehicles and public infrastructure (buildings, railway stations etc) from the potentially fatal effects of toxic gases such as used in industry and warfare. Whilst often effective in protecting people, the drag between the air and the nanoporous carbon material means the pressure drop across the filter is significant. For personal gas masks, this high pressure drop makes it more difficult for the person being protected to draw breath (the 'physiological burden' is said to be high). In the cases of vehicles and infrastructure, this high pressure drop requires significant power to overcome, making them less sustainable.

The Defence Science and Technology Organisation (DSTO) is looking to exploit more open nanoporous fibre networks (an example of such a network is shown above) to bring the same level of protection as the traditional technology but with substantially lower physiological burden. This project is concerned with identifying the fibre and fibre network characteristics that bring optimal performance in the sense of meeting the required level of protection at the lowest physiological burden. This will involve bringing together a model for the nanoporous fibre networks with mesoscale models for fluid flow and mass transfer in such networks to predict the performance of such networks. The putative optimal designs determined through this modelling approach will be made and tested in the laboratory.

There are many more projects in the areas of nanostructured materials. Feel free to contact me (mark.biggs@adelaide.edu.au; +61-8-8303-6317) or drop in to my office (N119) if you want to have further discussion or other possible PhD projects.

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