Group B3 14:00-16:00  Bronte Room

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Doped Vanadium Oxides Prepared by Liquid Injection MOCVD

Atmospheric pressure liquid injection MOCVD was used for the deposition of tungsten doped vanadium (IV) oxide coatings. The deposition was carried out on commercial SiO2-precoated glass using 0.1 M solution of vanadyl acetylacetonate (VO(acac)2) in methanol (CH3OH) at 0.02 L min\(^{-1}\) and 0.04 L min\(^{-1}\) oxygen flow rates at 450 °C and 0.8, 1 and 2 at % W using W(OC2H5)5. The crystallinity, uniformity, oxidation phase, optical properties, composition and morphology of the films were evaluated by X-ray diffraction, IR reflectance-transmittance, Raman spectroscopy, Rutherford backscattering spectroscopy and scanning electron microscopy respectively. The relationship between dopant concentration and transition temperature (Tc) in the most applicable range for solar window coatings was refined by formation of a single-phase film and precise determination of these parameters. Results obtained demonstrate a reduction in thermochromic Tc from 60 °C in VO2 to 35 °C in V0.98W0.02O2.
The high mortality rates associated with vascular diseases, complexity of the system and the inability of medical equipment to provide necessary in vivo data make numerical modelling of vascular problems an important factor in modern medicine. This paper examines the capabilities offered by the explicit dynamics FSI algorithms in LS-DYNA for solving problems in vascular biomechanics. The onset of a physiological pulse was simulated at the entrance of a straight segment of artery and the resulting dynamic response in the form of a propagating wave through the vessel wall was analysed. Initial results indicate that despite problems posed by hourglassing in the model, LS-DYNA has the potential to offer reliable results for values of Young’s modulus in the physiological range. Future work is to concentrate on expanding the range of Young’s moduli the model is valid for as well as for designing a large scale model of the physics of a blood vessel.

Research Institute: Institute for Materials Research
Thesis Title: Blood Vessel Fluid Structure Interaction
Supervisor: Dr M Moatamedi
School: School of Computing, Science & Engineering
Huang, Jungang

**Spontaneous Fractal Spatial Pattern Formation**

Complexity focuses on commonality across subject areas and forms a natural platform for multidisciplinary activities. Typical generic signatures of complexity include: (i) spontaneous occurrence of simple pattern (e.g. stripes, hexagons), emerging as a dominant non-linear mode, and (ii) formation of highly complex pattern in the form of a fractal (with structure spanning decades of scale). However, to our knowledge, the firm connection between these two signatures has not previously been established. This is perhaps not surprising since system non-linearity tends to impose a specific scale, while fractals are defined by their scale-less character. Here we report a generic mechanism for spontaneous fractal spatial pattern formation; this mechanism has independence with respect to both the particular form of non-linearity and the particular context of the non-linear system.

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<tr>
<td>Thesis Title</td>
<td>Generation and application of fractal laser light</td>
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<tr>
<td>Supervisor</td>
<td>Dr Graham. S. McDonald</td>
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The propagation of spatial optical solitons – that is, non-diffracting beams – in a dielectric waveguide is routinely described by the Non-Linear Schrödinger (NLS) equation. This is a universal model for describing soliton phenomena, and occurs in many diverse branches of physics. However, NLS-based models suffer from potentially severe physical limitations in some regimes. For example, they cannot support multiple waves propagating at arbitrarily large angles with respect to the reference direction, or the interaction of these waves. Here, we present a brief overview of some aspects of Helmholtz soliton theory. This non-paraxial framework extends conventional soliton theory, and offers a full description of non-linear waves over the complete range of angular regimes. Consideration of angular aspects of the wave propagation problem gives rise to novel, non-trivial physical effects that have no counterpart in paraxial theory.