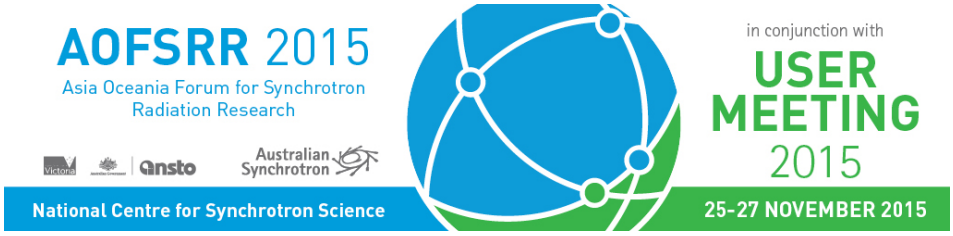

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Towards Iron-Carbon Multi-Functional Nanomaterials

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Carbon nanotubes (CNTs) have attracted significant attention and in many cases they have been used as a single-function additive to modify a specific property of a material, such as the mechanical strength of a composite. It is interesting to extend those properties by coupling them with properties of other materials, thus generating systems that can serve more complex functions (e.g., magnetic or metallic functions coupled with strength).

We report here on progress in a research activity directed at generating multi-functional materials based on CNTs and iron. The activity is focussed on controlling the production of the iron-carbon nanomaterials and is influenced by practical aspects of the production processes.

Towards multi-functional materials, we explore the synthesis of iron-containing multi-walled CNTs using chemical vapour deposition, where XAS data show the presence of metallic Fe phases under certain deposition conditions. Long-term storage and implications for the shelf-life of metallic iron inside CNTs will be discussed. Taking into account practical considerations, such as process scalability and energy efficiency, the deposition of magnetic Fe nanoparticles on oxygen functionalised multi-walled CNTs will be explored. Results from XAS, XPS and SEM show that short deposition times lead to thin, discontinuous iron films with a high proportion of Fe(II/III). As the deposition time increases, so do film thickness and Fe(0) content. Furthermore, magnetic measurements show a reduction in coercivity with increased deposition time, however, not to the extent expected for bulk metallic Fe.

Keywords

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