

APT Studies of Carbon-related Materials

Ross K.W. Marceau¹

¹ *Deakin University, Institute for Frontier Materials, Geelong, VIC 3216, Australia;*
e: r.marceau@deakin.edu.au

Atom probe tomography (APT) is a technique that provides a combination of highly resolved chemical and spatial information in three dimensions with the ability to detect all the elements (and their isotopes) in the periodic table. This talk will address its use in recent research at Deakin to investigate two different types of materials, each with a different focus on carbon.

Evolution of carbide precipitates in Ti-Mo microalloyed steel

Interphase precipitation of carbides imparts major strengthening effects in microalloyed steels. The precipitates formed in Ti-Mo steels are particularly known for their fine scale (~ 5 nm) and excellent thermal stability, which therefore makes them attractive for structural parts in the automotive industry, however the role of Mo is not clearly understood. In the present work, the isothermal evolution of carbide precipitates has been investigated as a function of carbide-forming element concentration (Ti, Mo and C) and simulated coiling time at a temperature of 650 °C. Complementary techniques, APT and small-angle neutron scattering (SANS), have been used to evaluate the evolution of particle radius and volume fraction. An APT data analysis procedure has been developed to assess the chemical composition of the carbides, where possible misidentification of matrix atoms (mainly Fe) due to the local magnification effect from the difference in field evaporation potential between the matrix and precipitates has been resolved.

Molecular-scale analysis of carbon fibre

Carbon fibre composites are increasingly being utilised across a wide range of industries. Currently there is a gap in knowledge concerning the micro- and nano-scale structure-property relationships that govern the mechanical properties of the individual carbon fibres and therefore also the behaviour of the composite material. APT is a very suitable technique for analysis of carbon fibres, which are mostly comprised of light elements (namely C, H, N, and O) that are otherwise challenging to detect in combination with each other using other microscopy and microanalysis techniques. A summary of some of the key issues associated with the challenges and solutions to the analysis of carbon fibres using APT.