

# Professor J Paul Attfield Professor of Materials Science at Extreme Conditions

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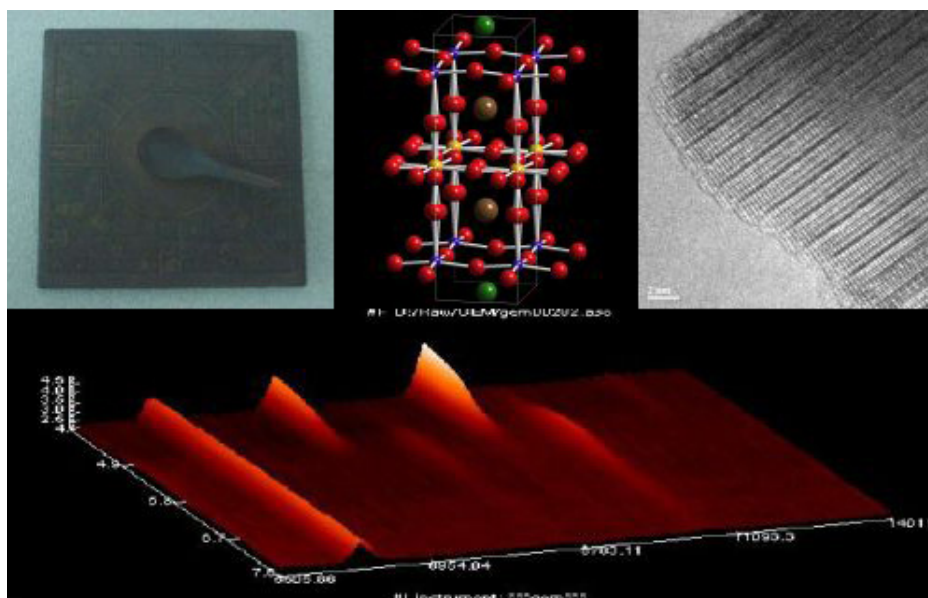
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Research Interests: magnetism, superconductivity, high pressure synthesis, materials chemistry



We are interested in the chemistry of materials that show notable physical properties. These are of fundamental interest, and may be important in the technologies of tomorrow. A central theme is to find how unusual conducting and magnetic properties depend upon chemical composition and structure. Materials under investigation include high-temperature superconducting copper oxides, transition metal oxides showing CMR (Colossal Magneto-Resistances - large variations of electrical resistance with magnetic field strength, used for storing and reading information on computer hard disks), charge ordered materials such as the mineral magnetite,  $\text{Fe}_3\text{O}_4$ , and layered rare earth borocarbides. We also participate in research collaborations on magnetic nanoparticles for MR imaging, ceramic nuclear wasteforms, and molecular crystal structure determinations using powder X-ray diffraction. Powder X-ray and neutron diffraction experiments are used to determine precise atomic structures of these materials. The data are collected in-house and at national and international synchrotron X-ray and neutron facilities in the UK and Grenoble, France.

A new research direction, starting from mid-2004, will be to synthesise and study the above types of material under high pressure. This research will form part of the programme of the [Centre for Science at Extreme Conditions](#) (CSEC).



## Selected Recent Publications

1. Magnetic Properties of  $\text{DyB}_2\text{C}$ ,  $\text{HoB}_2\text{C}$ , and  $\text{ErB}_2\text{C}$ . R. Watanuki, K. Suzuki, J. van Duijn and J. P. Attfield. *Physical Review B* **69**, 064433 (2004).
2. Cation size variance effects in magnetoresistive  $\text{Sr}_2\text{FeMoO}_6$  double perovskites. F. Sher, A. Venimadhav, M. G. Blamire, K. Kamenev and J. P. Attfield. *Chemistry of Materials* **17**, 176-180 (2005).
3. Weak charge-lattice coupling requires reinterpretation of stripes of charge order in  $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3$ . J. C. Loudon, S. Cox, A. J. Williams, J. P. Attfield, P. B. Littlewood, P. A. Midgley and N. D. Mathur. *Physical Review Letters* **94**, 097202 (2005).
4. Charge transfer and antiferromagnetic insulator phase in  $\text{SrRu}_{1-x}\text{Cr}_x\text{O}_3$  perovskites: Solid solutions between two itinerant electron oxides. A. J. Williams, A. Gillies, J. P. Attfield, G. Heymann, H. Huppertz, M.J. Martinez-Lope and J.A. Alonso. *Physical Review B* **73**, 104409 (2006).
5. Chemical tuning of positive and negative magnetoresistances, and superconductivity in 1222-type ruthenocuprates. A. C. McLaughlin, L. Begg, C. Harrow, S. A. J. Kimber, F. Sher, J. P. Attfield. *Journal of the American Chemical Society*, **128** 12364-12365 (2006).