MONASH University

DEPARTMENT OF MATERIALS ENGINEERING

ARC Centre of Excellence for Electromaterials Science

DIAMOND: THE ULTIMATE MATERIAL FOR NEARLY EVERYTHING

Dr. Mark Newton

Department of Physics, University of Warwick

U.K.

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Bruce West Seminar Room, Building 23

Diamond distinguishes itself from other materials with an impressive list of extreme properties. For instances unsurpassed mechanical hardness, low friction, low adhesion to other materials, highest bulk thermal conductivity, low thermal expansion coefficient, wide (optical) transmission band, high refractive index, chemical inertness, bio-compatible, radiation hardness, electric insulation (when pure), electrical conduction (when doped) and amazing electronic properties. It is the combination of amazing properties which means that diamond can outperform traditional materials in the most demanding mechanical, optical and electronic applications.

So why if it is so wonderful is diamond not exploited more widely? The first problem is that diamond is difficult to synthesize. In this talk diamond synthesis will be reviewed from the first experiments at high pressures and temperatures to the present day when worldwide considerable effort is focused on perfecting the growth of diamond by chemical vapour deposition (CVD).

The second problem is that like most materials the interesting properties of diamond are often controlled by minute concentrations of impurities and defects. Today we are witnessing a revolution in the synthesis of virtually defect free controllably doped diamond; we are continually being amazed by the properties of this new material. The results of recent spectroscopic studies, primarily using the technique of Electron Paramagnetic Resonance, on colour centres and dopants in diamond will be described.

Some of the exploitable properties of intrinsic and doped diamond will be discussed and hopefully it will be shown that diamond has a sparkling future in applications as diverse as electrochemistry and quantum computing!

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Convenor: Prof. Jian-Feng Nie

Tel: 9905 9605

Email: nie@eng.monash.edu.au