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Coherent Acoustic Phonon Spectroscopy of Ion-Implanted Diamond

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sala Castagnoli, Dipartimento di Fisica, via P. Giuria 1

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Abstract

If ion implantation is to be used for fabrication of photonic and optically-based quantum information devices in diamond crystals, a detailed understanding of the effects of ion implantation and annealing on the opto-electronic properties of the diamond lattice is necessary.

Coherent Acoustic Phonon (CAP) spectroscopy is an ultrafast optical method well suited to study these phenomena. CAP experiments are an advancement of standard ultrafast optical pump-probe techniques, and provide detailed depth-dependent information about the optical and electronic properties of materials in a non-destructive fashion.

In this talk I will describe a systematic study of the modulation of CAP oscillation patterns in diamond at a variety of He⁺ implantation doses, and extract relationships for how the implantation modifies the complex index of refraction of the diamond lattice, as well as its first derivative with strain. Comparing these results with computer simulations of implantation damage profiles yields a calibration relationship between optical properties and induced damage. These results will aid in the fabrication of photonic and quantum devices based on single-crystal diamonds.

The Author



Justin Mark Gregory graduated in Physics in 2006 at the Lipscomb University and is currently completing a PhD in Materials Science at Vanderbilt University. He was the President of the Student Physics Society at Lipscomb University Chapter in 2005-2006, and was awarded a NSF IGERT Fellowship in 2006. From 2009 to present day he has been appointed as Adjunct Professor at the Lipscomb University. He worked on the development of the Coherent Acoustic Phonon (CAP) spectroscopy technique, which recently obtained a significant resonance within the Solid State Physics community¹.

References

- 1 "Radiation damage a bigger problem than previously thought", Materials Today News, 24 July 2012 (short link: <http://goo.gl/3BKZh>)