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# Study of superconducting gap in boron doped nanodiamond through differential resistance

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## Abstract content <br>   (Max 300 words)<br><a href="http://events.saip.org.za/getFile.py/a target="_blank">Formatting &<br>Special chars</a>

Unconventional superconductors which are a possible route to high temperature superconductivity are widely studied as they offer interesting correlated systems; yet they still pose a variety of unanswered questions. In particular studies of the superconducting gap through differential conductance measurements may yield valuable insight into the mechanism responsible. Here we study differential conductance over various magnetic fields of a set of boron doped nanocrystalline diamond samples. The granular microstructure of these nanocrystalline samples results in a difference between local properties (such as boron concentration) and bulk properties. It is generally believed that the grain boundaries separating the grains are non-superconducting. The temperature dependence of all samples showed a superconducting transition with Tonset ˜ 2.5 K. For the sample with lower boron doping, current-voltage measurements showed a metallic normal state with a decrease in temperature and magnetic fields shifting the sample into a second metallic state of much lower resistance. This local superconductivity (where some grains become superconducting and do not contribute to the resistivity of the sample which is now made up of the metallic properties of the remaining grains) is believed to arise from inhomogeneity between the grains. in the highly doped samples we found a complete change in the current-voltage characteristics at the transition resulting in a minimum in the differential resistance, with the minimum resistance increasing rapidly in the presence of a magnetic field. Magneto resistance measurements in these samples confirmed the breakdown of superconductivity at low magnetic fields with an additional peak (not seen in low boron concentration samples) in the magneto resistance at the transition. These results offer valuable insights into the mechanism behind unconventional superconductivity in carbon systems.

## Apply to be<br> considered for a student <br>   award (Yes / No)?

Yes

## Level for award<br> (Hons, MSc, <br>   PhD)?

MSc

## Main supervisor (name and email)<br>and his / her institution

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**Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?**

No

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