Control of Metallic and Superconducting Properties of Metal Mixed Plastics

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Metal mixed polymers are a cheap and effective way to produce flexible metals and superconductors [1]. As part of an on-going effort to learn how to control the properties of these systems with ion implantation, we present a study of the electrical properties of these systems prior to [2], and after, metal-mixing.

We show that the electrical properties of tin-antimony thin films are remarkably robust to variations in the substrate morphology. We find that as the film thickness is reduced, the superconducting transition in the unimplanted thin films is broadened, but the onset of the transition remains at ~3.7 K, the transition temperature of bulk Sn.

This is in marked contrast to the behavior of metal mixed films, where the superconducting properties are greatly affected by the level of disorder introduced by the metal-mixing process. We show that the superconducting properties can be controlled by two of the implant parameters: film thickness and implant temperature. Thus these materials are tunable systems for investigating the interplay of localization, superconductivity and disorder in two dimensions.

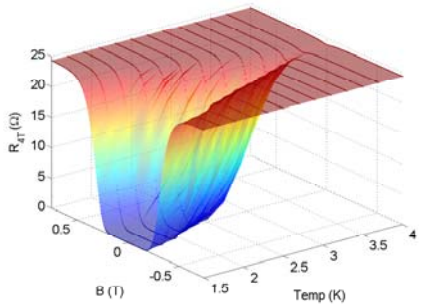

Figure 1: Magnetoresistance of a Sn-Antimony metal-mixed polymer.

[1] A. P. Micolich *et al.*, Appl. Phys. Lett. **87**, 155203 (2006)
[2] A. P. Stephenson *et al.*, J. Appl. Phys. **105**, 093909 (2009)