# The Impact of Processing on Hydrogen-Terminated Diamond TLM Structures Exposed to Atmosphere and Coated with F16CuPc

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When diamond is hydrogen-terminated it gives rise to a negative electron affinity and significantly lowers its ionisation potential. The surface transfer doping model suggests that when high electron affinity molecules from the atmosphere adsorb on to the diamond surface a transfer of charge takes place, leaving behind a sub-surface layer of holes and p-type conductivity. Unfortunately this is difficult to control and unstable when subjected to the sort of processing required for making electronic devices. Hence a replacement for these atmospheric adsorbates is required.

In this work Transmission Line Model (TLM) structures were fabricated on Element Six homoepitaxial single crystal (001) diamond to examine modification to the sheet resistance of the diamond surface with and without encapsulation with the organic semiconductor material F16CuPc (hexadecafluorophthalocyanine). Similar to the work performed utilising organic molecules such as C60 [1-2] F16CuPc is chosen due to its high electron affinity and could potentially replace atmospheric adsorbates in the surface transfer doping process.

Both sets of encapsulated and atmosphere exposed TLM structures were then subjected to a series of different processing conditions (such as heating, coating in resist and electron beam exposure) to discover the impact on the sheet resistance.

For all processing steps the sheet resistance always recovers to roughly its original value in the case of the non-coated TLMs which suggests that atmospheric adsorbates which coat the hydrogen terminated diamond surface will re-adsorb and bring the sheet resistance back to its original value so long as the hydrogen-terminated surface itself has not been damaged.

Preliminary results of coating with F16CuPc are encouraging, after deposition the TLMs still conduct with sheet resistance not significantly altered (Fig. 1). This organic coating should certainly be investigated further along with other suitable candidates.

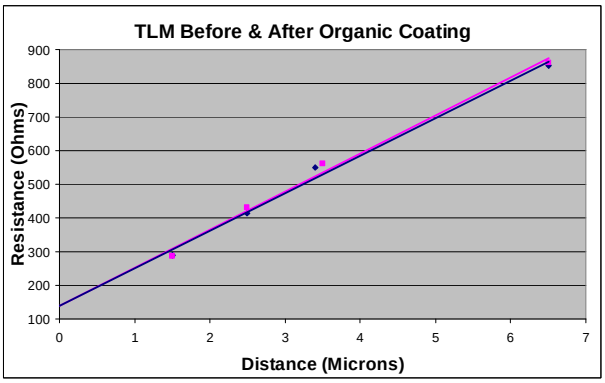


**Figure. 1: TLM resistance plot showing negligible change after deposition of F16CuPc**

*References:*

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