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Radiation Hardness Test of Copper Conductive tapes.

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The radiation hardness of a copper tape was previously reported using Co^{60} sources (ATL-IT-TR-0026). After 20 MRad of irradiation, the electrical conductivity of a piece of the tape joining two metallized Kapton foils deteriorated substantially. We have conducted a similar test and found that there is no degradation unlike the earlier test.

We have tested two samples. One is Saint-Gobain Furon CHR type C665 tape, http://www.furon.com/media/documents/CHR%20brochure.pdf, which is similar to the one used in the earlier test (made by 3M). The difference between the two tapes is the thickness of the adhesive. C665 tape has adhesive about twice thick (foil thickness: 0.038 mm, adhesive thickness: 0.051 mm). Note that the adhesive is **conductive** in both samples. We do not know if the adhesive material is identical.

The other sample tested is 3M type 135 tape. This tape has **non conductive adhesive** layer. The conduction between the tape and the taped surface relies on the physical contact of copper with the surface. This is accomplished by embossing the surface (see figure below). The embossed edges cut through the adhesive layer.

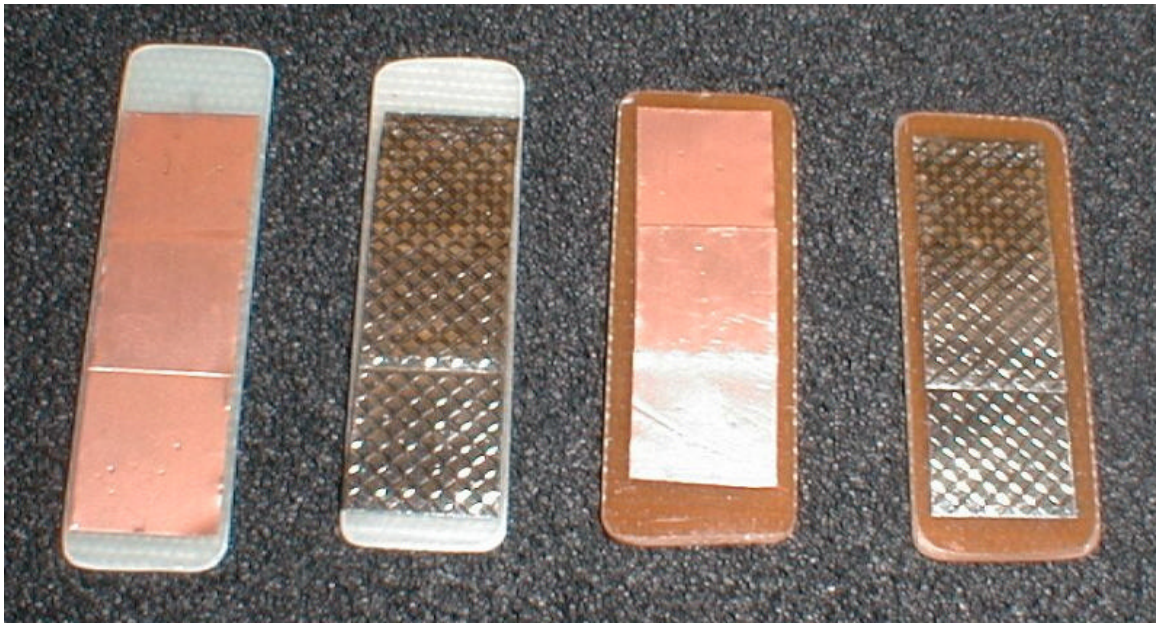

Figure 1. The two left samples are control samples and the two right samples are irradiated samples. Note the difference between plain tape and embossed tape. You can see the overlap region of two tapes.

For the conductivity test, two tapes were overlapped ~ 5mm and pressed down by a finger (the pressure is not measured). This was to simulate the RF shielding technique of the end frames of the barrel support structure. The samples (6 in total) were sent for Co^{60} irradiation. The rate of irradiation was 1 MRad/hour and total of 20 MRad was accumulated. After irradiation there was no obvious color change but the base material (G10) changed color from green to brown (figure above). The resistance between two ends of the tape was measured before and after the irradiation and they all registered between 0.2 and 0.4 ohm.

In summary, we tested two types of copper tape, plain type and an embossed type. Unlike the previous test at CERN, we do not observe any degradation in the conductivity between the tape and the taped surface after 20 MRad of Co^{60} irradiation. We do not understand the reason (we have some speculations). The embossed type does not rely on the conductivity of the adhesive and may be better suited for the high radiation environment.