

From: FNTS01::TNICOL "Technical Support/Engineering, x3441, MS 316" 4-APR-1990 16:1  
 To: FNAL::MANTSCH,FNAL::JBS,KERBY  
 CC:  
 Subj: Here is a summary of Finley's thoughts on the new kapton...

From: FNAL::FNTS06::MARKLEY 4-APR-1990 10:52:58.10  
 To: FNAL::TNICOL  
 CC:  
 Subj: NEW AND OLD KAPTON INSULATION

Both FNL and BNL have evaluated the new Dupont Kapton for its ability to withstand pressure in an SSC coil assembly without a failure leading to electrical breakdown.

Data from both labs over many tests of the new Kapton is in very good agreement. The pressure to break down the insulation between 2 cables each covered with 2 half-lapped layers of new Kapton is 50 to 60 kpsi.

FNL has made many tests of old Kapton, but I am aware of only two such measurements by BNL. These were reported by Skaritka at the Jan. 1989 MISM meeting. FNL data agrees with the reported value of 56 kpsi for a single layer of half-lapped old Kapton covered with a layer of uncured epoxy-fiberglass tape.

FNL data does not agree with the reported value of 17 kpsi for the same system in the cured condition. We find greater than 30 kpsi. To my knowledge, the BNL measurement represents a single test with an unknown number of replications since the original data may be lost, and it is the only test where there is disagreement between labs. The FNL data is the result of one test of a full outer coil section 3 inches long, supported in a curved fixture and slowly loaded while noting the pressure at which turn-to-turn shorts occurred; one test with 5 replications of cable pairs in a BNL type fixture (41+/-4 kpsi); two tests with 4 & 5 replications of cable pairs in an FNL type fixture (28+/-1 kpsi and 37+/-2 kpsi); and many, many tests of cable pairs without the epoxy-fiberglass ( about 30 kpsi).

At FNL we have also made direct comparisons of the new and old Kaptons as single and double layers half-lapped on cable pairs without epoxy-fiberglass in both FNL and BNL type fixtures. The two Kaptons give identical breakdown pressures within experimental error. The values are about 30 kpsi for single layers and 50 to 60 kpsi for double layers. In the case of double layers we have tried 6 different combinations of the 3 new Kapton types with essentially the same results, and old Kapton with and without a 3M's adhesive coating also with the same results. All three new Kaptons types as single layers give the same results as old Kapton single layer.

We have not yet received any XMPI adhesive coated on Kapton, but we see no reason for the adhesive to cause a difference between the base film types response to pressure. There will be a difference between any film with and without adhesive if the adhesive is present in enough volume to fill the spaces between cable strands on the cable surface. Deliberately filling those spaces with epoxy can increase the breakdown pressure of a single layer half-lapped of old Kapton from 30 kpsi to something in the range 60 to 90 kpsi for edge restrained cable.

FNL data was presented at the March meeting in Miami of the Second International Industrial Symposium on the SSC, and will be published. Preprints of the paper are available.

#### CONCLUSION

New and old Kaptons films, tested on SSC cable, will breakdown electrically at substantially the same pressures. Since the new Kapton is reported to be more expensive than the old (especially with the XMPI adhesive), its use must be justified on other properties than the pressure it can support before it fails and allows electrical breakdown between two adjacent SSC cables. Dupont has said that the probable per square foot costs are:

old Kapton-----\$0.50  
 new filled Kapton-----\$1.00  
 XMPI coated new filled Kapton--\$2.20