



1970's

Polyimide Resin

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In the late 1970s, organic material was first introduced into the process of interconnect interlayer insulating films and protective films of chips. It was Polyimide-based polymer material.

Application of polyimide resin to semiconductor manufacturing was announced by Hitachi in 1973 as a multilayer interconnect interlayer insulating film [1]. It was a method of spin-coating varnish-like polyimide stock solution and curing to form a polyimide film, which had the effect of flattening the insulating film on the irregularities formed by Al interconnect. In 1977, Hitachi applied it to the multilayer interconnect interlayer insulating film of linear IC, and then many companies adopted it for multilayer interconnect of bipolar ICs.

Polyimide is polymeric resin containing imide group with the softening point (the maximum temperature at which mechanical and electrical properties are maintained) of about 250 ° C. It came to be known in the 1980s as the most heat-resistant material among the organic materials. For that reason, expectations increased in industrial, space, military applications, etc., and it was commercialized by Du Pont in 1961 (trademark; Kapton). First application to semiconductor as the semiconductor structural material was the polyimide which was a co-polymer of imide ring and iso-indolo-quinazoline developed by Hitachi, which had improved characteristics of heat resistance and abrasion resistance. In 1973, Hitachi Chemical (currently HD Microsystems) purified the monomer to the semiconductor grade high purity and started selling it (trade name; PIQ).

Since PIQ has corrosion prevention effect of aluminum (Al) interconnect, and Young's modulus (modulus of elasticity) is larger than that of inorganic materials, providing for crack (film crack) free feature at the thickness of over 10 μm or more, it was also used as the passivation film of MOSLSI chip. After the 3 μm process where soft errors due to alpha rays became a problem at the end of the 1970's, it was also used as an α-ray shielding film.

Currently, polyimide resins are also used as the insulation films for SIP (System in Package), and polyimide resins having various characteristics are being developed and sold from many companies.

References:

- [1] K.Sato, S.Harada, A.Saiki, T.Kimura, T.Okubo, and K.Mukai, IEEE Trans. Parts, Hybrids & Package, PHP- 3, p176 , 1973