

Sintering and consolidation of silver nanoparticles on polyimide substrate films

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Silver nanoparticles with diameter around 50 nm were spin coated on the polyimide substrate films under the thermal treatment. The densification of metastable silver nanoparticles was investigated as a function of heat treatment temperatures between 180°C to 300°C around the nanoparticle melting temperature of 258°C. Sintering seemed to occur at 180°C, where the necks are formed at the contact points of nanoparticles to reduce the overall surface area and the overall surface energy. As temperature is increased up to 250°C, silver atoms diffused from the grain boundaries at the intersections between differently oriented particles and continued to deposit on the interior surface of the pore, thereby filling up the remaining space. When the consolidation temperature was over 270°C, the capillary force between the spherical silver particle and polyimide flat surface seemed to induce elastic deformation of polyimide films in the rubbery state.