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# Physical and mechanical properties of microelectronic interconnecting elements based on aluminum-polyimide film composition

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Physical and mechanical properties of a binary aluminum-polyimide film structure have been studied from the viewpoint of its use as a construction material for precision cables made by film microelectronics methods. Limitations in resolution (conductor spacing) have been formulated. Thermal stresses in the composition have been estimated by calculation. The design methods to eliminate the undesired effects of thermally induced mechanical stresses on the subsequent device assembling operations have been proposed and checked in experiment.

Исследованы физико-механические свойства бинарной пленочной структуры алюминий-полиимид с точки зрения использования ее как конструкционного материала прецизионных кабелей, изготавливаемых методами пленочной микроэлектроники. Сформулированы ограничения по разрешению (шагу проводников), расчетно оценены термонапряжения в композиции, предложены и экспериментально апробированы конструктивные методы устранения нежелательного воздействия термомеханических напряжений на последующие операции сборки приборов.

The aluminum-polyimide film composition is used for a long time enough to connect the caseless microcircuits (MC) [1, 2]. Its advantages in interconnection of devices, especially those operated under irradiation, include: elimination of heavy metals (copper, gold, tin, etc.); the regular arrangement of the cable terminals over the MC contact areas; 50 to 60 per cent reduction of the connection number as compared to the wire connection of cased MC; the possible unhindered displacement of connected components in the course of general instrument assembling (in practice, within length limits of the connecting cable). Up to now, however, the foiled dielectric was used only to connect MC with the conductor spacing of at least 200 μm. The cable overall dimensions did not exceed 20-30 $mm^2$ [2].

In connection with wide use of imported elements and increased interest of users in instruments operable under irradiation (X-ray tomographs, dosimetric devices, high-energy physics, etc.), the instrument designers are faced with problems of low-noise connection and spatial arrangement of components.

The purpose of this work is to study physical and mechanical properties of the binary aluminum-polyimide film composition and to determine the technologic design limitations in connecting film components made of that composition.

A version of the film cable construction is presented in Fig. 1 [3]. It is a system of conductors and holes in polyimide. The holes are intended to open locally the dielectric base for subsequent electric interconnection (of conductors) and the cable surface perforation to separate the working area out of technologic one.