

# Studies on a mechanism of catalytic mask generation in irradiation of an Al-Si structure with high-voltage gas-discharge particles

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## Abstract

The article considers a liquid aluminum-silicon system, irradiated by an ion-electron flow generated by a high-voltage gas discharge (HVGD) with a particle energy of up to 6 keV. The work illustrates theoretically that a flux of atomic-sized voids ("vacancies") can exist in the liquid phase of aluminum (mask) when its surface is irradiated with negatively charged HVGD particles with the energy up to 6 keV. The results of experimental studies are presented, and they are in good agreement with the effect of dragging the silicon atoms by the flow of "vacancies". The feasibility of forming a catalytic mask for creating a microrelief of diffractive optical elements (DOEs) is shown. By means of lithography, a standard DOE photomask is transformed into a catalytic mask on the basis of liquid aluminum. The article shows the possibility of dosed predeposition of semiconductor atoms into the melted masking material by changing the modes of irradiation of the aluminum-silicon (Al-Si) structure immediately during the technological process. Subsequent removal of the semiconductor-saturated catalyst mask layer results in the formation of a diffractive microrelief.

**Keywords:** catalytic mask, Al-Si structure, gas discharge particle, HVGD, negatively charged particle, DOE, diffractive microrelief.

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[Access full text \(in Russian\)](#)

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