

Recovery of germanium optical elements for infrared technique devices

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Germanium optical elements are widely used as passive components (lenses, prisms, windows, protective screens) of the great majority of infrared devices. During operation, especially under extreme conditions, such elements frequently suffer mechanical damage or lose transparency resulting from the degradation of anti-reflective coatings.

The report presents the results of physical-technological and chemical-technological research aimed at the development of methods for removing anti-reflective coatings from the surface of germanium optical elements and their subsequent removal from the coating layer. The material of anti-reflective coatings, which penetrates into the near-surface layer of the optical elements during their manufacture and operation, makes it impossible to restore the optical elements.

The results of the development of etchant composition as well as of the technological regimes of removing the material of anti-reflective coatings from the surface and near-surface layer of optical elements are given. A technique for determining the concentration of impurities in optical elements after removing the anti-reflective coating has been developed. The results of the approbation of the developed technique show that it allows determining the concentration of electrically active impurities at the level of $(5-7) \times 10^{13} \text{ cm}^{-3}$. Germanium optical elements, cleaned of anti-reflective coating by the proposed technical method, can be used both for repeated application of new anti-reflective coatings with their further use in infrared technology, and for processing into raw materials for growing germanium optical crystals without the use of rectification refining methods.

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