Solid state immersion for the visualizing defects in a diamond

Nastulyavichus A A[1,@], Smirnov N A[1], Kudryashov S I[1], Khmelnitsky R A[1], Levchenko A O[1], Kuznetsov S V[2], Egorov A B[1], Shutov V V[1] and Ionin A A[1]

[1] Lebedev Physical Institute of the Russian Academy of Sciences, Leninsky Avenue 53, Moscow 119991, Russia
[2] LLC Microlaser, Bolshoi Boulevard 42, bldg 1, Moscow, Moscow region 121205, Russia

[@] nastulyavichusaa@lebedev.ru

Diamond is a mineral with unique functional physical and chemical characteristics, and its high refractive index makes it extremely attractive for use in the jewelry industry [1]. An important task is to visualize the internal structure of rough diamonds to identify defects and their localization. Visualization of the internal structure of a rough diamond is hampered by the presence of facets, due to which, due to the high refractive index (n=2.4), a strong refraction of light rays occurs at the air-diamond interface. Using high-temperature lamellar deformation in an argon atmosphere, diamond samples were sealed into an immersion solid-state composition based on ZnSe to visualize the internal structure of diamond in the visible region of the spectrum. The absence of pyrohydrolysis processes at the ZnSe-diamond interface was shown by the following methods: Raman scattering of light, X-ray phase analysis, scanning electron microscopy with energy dispersive analysis. Chalcogenide glass Ge7Se93 has proven itself as a good mid-IR immersion material for reducing scattering losses [2]

The work was supported by the grant of the Russian Science Foundation (project 21-79-30063).

[1] Wort C J H and Balmer R S 2008 *Materials today* **1–2** 22–28
[2] Khmelnitsky R A, Kovalchuk O, Gulina Y, Nastulyavichus A, Kriulina G Y, Boldyrev N, Kudryashov S, Levchenko A and Shiryaev V 2022 *Diamond and Related Materials* **128** 109278