Abstract Submitted
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Elastic moduli of hard c-Zr_3N_4 and η-Ta_2N_3, a tough self-healing material, via laser ultrasonics and nanoindentation[1] ANDREAS ZERR, LSPM-CNRS, Villetaneuse, France, NIKOLAY CHIGAREV, LAUM, Universite du Maine, Le Mans, France, JUDITH BOURGUILLE, FLORENT TETARD, OVIDIU BRINZA, SERGEY NIKITIN, LSPM-CNRS, Villetaneuse, France, ALEXEY LOMONOSOV, Institute of General Physics, Moscow, Russia, VITALYI GUSEV, IMMM, Universite du Maine, Le Mans, France — Bulk and shear moduli (B_0 and G_0) of the dense polycrystalline oxygen bearing c-Zr_3N_4 and η-Ta_2N_3 were determined from the laser ultrasonic (LU) measurements on highly porous samples having the volume fraction porosity of 0.23 and 0.18, respectively. Dense samples of these high-pressure (HP) materials are today not available due to their very high hardness and absence of a densification procedure. Combining the LU data with a numerical analysis of the sample porosity, the "true" isotropic moduli were determined to be B_0 =217(20) GPa and G_0 =163(9) GPa, for c-Zr_3N_4, and B_0 =281(15) GPa and G_0 =123(2) GPa, for η-Ta_2N_3. For both HP-nitrides the B_0 values agree with those obtained earlier via the HP compression measurements in a diamond anvil cell. Also, the self-healing behavior of η-Ta_2N_3 by mechanical polishing was confirmed by two independent methods. Finally, the results obtained for η-Ta_2N_3 via the LU method were compared with our nanoindentation measurements. The high G_0 value of c-Zr_3N_4 suggests that this material could vie with γ-Si_3N_4 for the rank of the third hardest material after diamond and c-BN.

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