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Borosilicate glasses doped with gadolinium oxide and/or dysprosium oxide for neutron guides and process for obtaining them

Patent: A00797/ 2021

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- The invention relates to a novel product, boron-silicate glasses doped with gadolinium oxide and/or dysprosium oxide for neutron guides and a process for obtaining them.
- The doped boron-silicate glass contains: (1) glassy formers: 50-80% molar boron oxide - B_2O_3; 10-30% molar silicon dioxide - SiO_2; (2) glassy modifiers: potassium oxide - K_2O, in a proportion of 0-20% molar; sodium oxide - Na_2O, in a proportion of 0-20% molar; (3) chemical, thermal and mechanical stabilizers: aluminum oxide - Al_2O_3, 2-10% molar; zinc oxide - ZnO, 0-10% molar; magnesium oxide, MgO, 0-10% molar; (4) together with oxides which induce the properties of neutron transport and radiation resistance, in percentages of 0-15% molar, of the following rare earth oxides, introduced alone or in pairs: Gd_2O_3 and / or Dy_2O_3.
- The process for obtaining this new type of glass comprises the operations of weighing, mixing-homogenizing the raw materials, pre-melting, melting, refining, homogenizing, conditioning, pouring, annealing, and shaping the glass obtained, followed by its treatment in a flux of thermal neutrons (0.025 eV) of 10^2 n_{th} cm^{-2} s^{-1}.

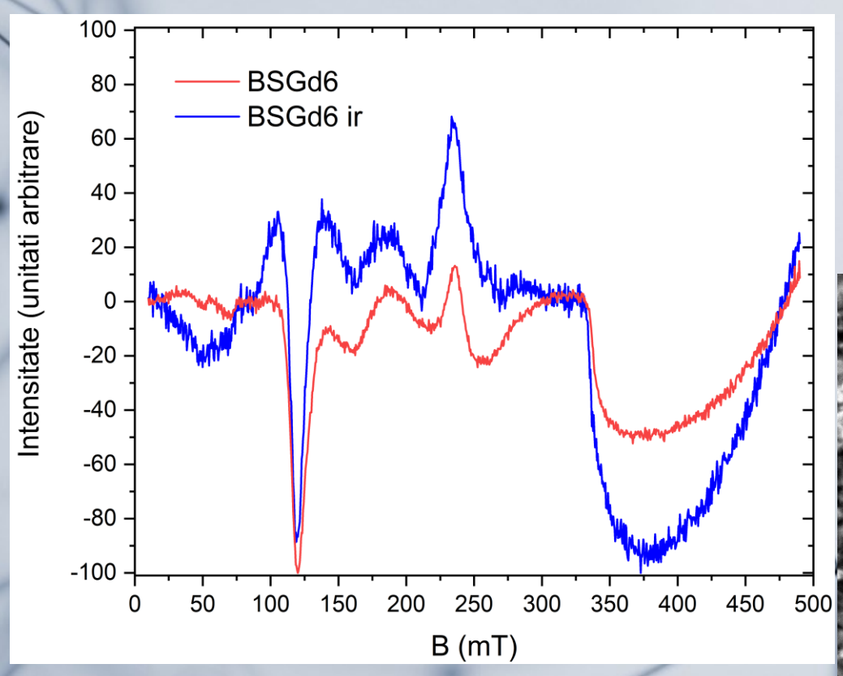

Figure 1. Electronic paramagnetic resonance for 6% Gd_2O_3 doped glass, before and after irradiation.

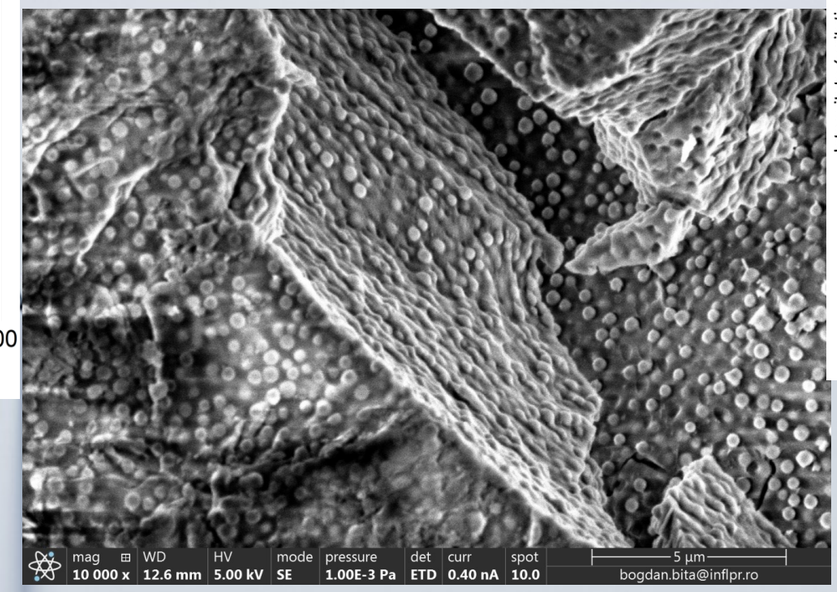

Figure 2. SEM image of 6% Gd_2O_3 doped glass

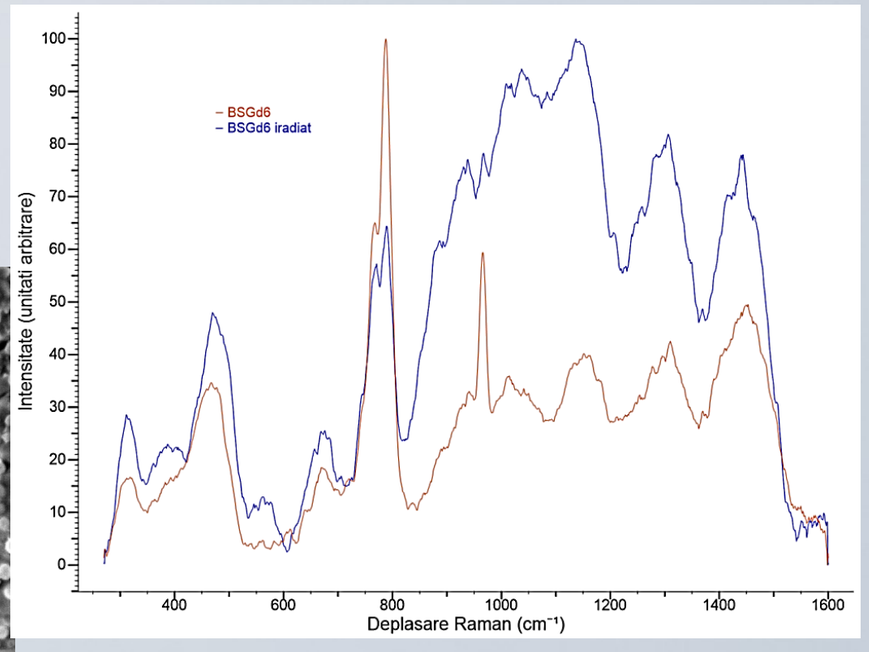

Figure 3. Raman spectrum of 6% Gd_2O_3 doped glass, before and after neutron irradiation.

- The advantages of these glasses refer to their use as thermal and cold neutron guides, with superior performance to existing ones, in terms of resistance to the effect of prolonged radiation exposure. The applications of these glasses are their use for the manufacture of high-performance thermal and cold neutron guides in terms of resistance to neutron radiation.

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