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«Metrological Support of Innovative Technologies» ICMSIT-2020

«Improving the radiation-thermal stability of titanium hydride»

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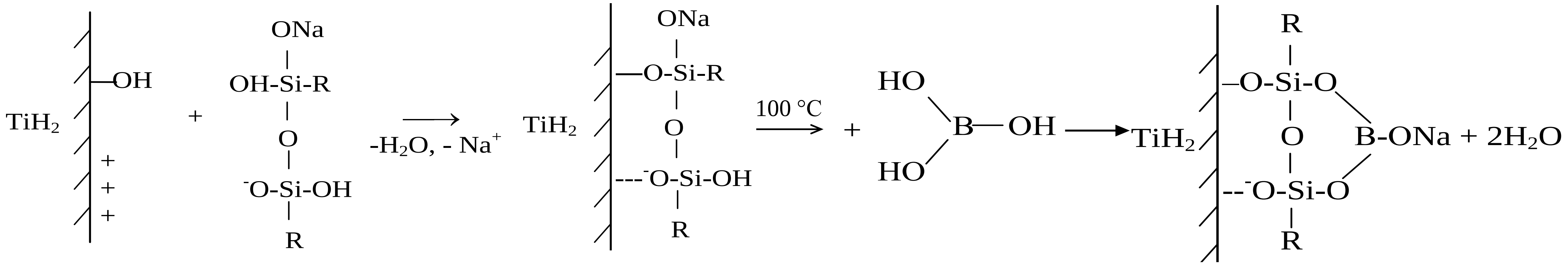
Metrological Support of Innovative Technologies

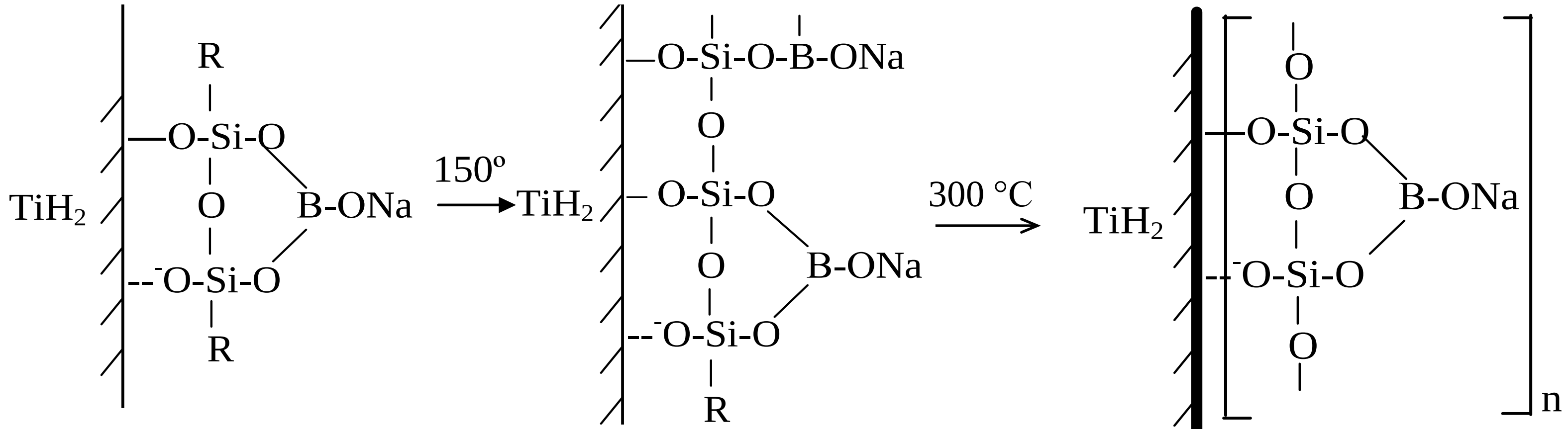
Problem statement

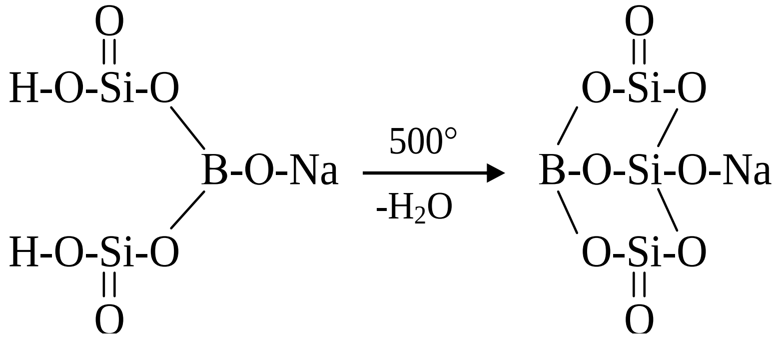
- One of the priority areas of research for metal hydride systems is to increase their radiation-thermal resistance in order to expand the scope of application in modern energy as neutron protection materials.
- Increasing the initial temperature of thermal diffusion of hydrogen in titanium hydride is one of the main problems of its use in radiation protection constructions and ensuring the safe operation of stationary and transport nuclear power plants.
- One way to increase the radiation-thermal stability of titanium hydride is to artificially create hydrogen impurity "traps" on its surface.
- The creation on the surface of titanium hydride particles of a borosilicate skeleton containing borate groups with 2p atomic orbitals unfilled at the external level will allow efficiently retaining diffusing hydrogen due to the formation of boron-hydrogen complexes.

Solution methods

Modification of titanium hydride by the method of surface assembly with preliminary immobilization of an activating organosilicon layer leads to the formation of a stable framework type borosilicate on its surface:







$NaBSi_3O_8$ - frame borosilicate of triclinic syngony

Results and Conclusions

- The presence of chemically bonded boron atoms on the surface of titanium hydride particles increases the initial dissociation temperature of titanium hydride.
- Mechanisms for modifying the surface of titanium hydride by surface assembly and the creation of a borosilicate framework have been established.
- The presence of a borosilicate skeleton of a modifier on the surface of titanium hydride particles increases its thermal stability by 185 °C, shifting the onset of dehydrogenation processes to the high temperature region from 463 °C to 649 °C.

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