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P2.3003 Functionalized porous silicon structures for promising plasma energy systems

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Currently, the developments in the field of alternative energy are becoming increasingly important due to the need to solve a vast number of problems associated with the creation of compact, reliable, autonomous power sources for spacecraft and other applications, where the conversion of solar energy into electrical energy is of particular interest. Traditionally, this process is implemented according to one of two fundamental principles: "quantum" approach, presented in photovoltaic cells, and "thermal" mechanism, requiring the presence of concentrated radiation to generate electricity using various heat engines (i.e. thermionic energy converters or TECs). In practice, devices that combine both paradigms lose their effectiveness due to the rapid destruction of photovoltaic cells, caused by a significant increase in operating temperatures required to maintain the thermionic emission current density at a reasonably high level.
Concentrators based on the effect of photon-enhanced thermionic emission (PETE) make it possible to realize photovoltaic and thermionic phenomena in a single physical process. The possibility of synthesizing systems based on PETE with semiconductor (GaN) electrodes was demonstrated in [1], however, the number of incident photons, exceeding the band gap of GaN (Eg = 3.3 eV), is less than 1% of their total thus the combined energy conversion efficiency decreases dramatically. In this study new materials based on porous silicon (PS) for the subsequent synthesis of PETE electrodes are proposed, since the value of Eg for PS varies in a wide range from 1 to 3 eV due to the quantum confinement effect, as well as mechanisms for surface functionalization [2, 3].

References
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