HYDRODYNAMIC AND BOILING PROCESSES ON THE SURFACE OF NANOCOMPOSITE SILICON-CARBIDE CERAMIC

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Silicon carbide ceramics (SiC) is unique composite that has many chemical and mechanical peculiarities that inspire the scientific researchers to study it from all directions [1]. In this work, we studied hydrodynamic and thermal processes on the surfaces of SiC ceramics: wetting properties, characteristics of liquid movement and nucleate pool boiling (heat transfer in deionized water under atmospheric pressure). SiC ceramics were made by spark plasma sintering using the GT advanced Technologies SPS10-4 system from a powder obtained by plasmodynamic synthesis [2] with an average grain size of 70 nm. The later knowledge contribute to know more information about: static contact angles (SCA) in range of (46° – 74.9°), free surface energy (SFE) in range of (35.36–56.13 mN/m), and three-phase contact line speed in range of ($0{,}02 \cdot 10^{-3}$ – 0.005 m/s), as well as opening new fields to receive new knowledge about roughness characteristics such as maximum height (Sz) that is changed in range of (23.4 – 41.5 μm) and influence boiling process on it that is textured by laser irradiation. The wettability was estimated by the value of the SCA obtained by shadow optical method (high-speed video camera and plane-parallel light) [3], when a 10-μl drop of distilled water was placed. The SFE was calculated according to the OWRK (harmonic average method) and the Wu (geometric mean method) [4].

The characteristics of liquid movement (three-phase contact line movement in “water/SiC/air” system and dynamic contact angle) were obtained by pumping/pumping out liquid on the surfaces using a high-precision syringe pump. Shadow images of droplet for wetting and spreading experiments were processed using goniometry methods. The pool boiling process was studied according to thermocouples readings and visualization by high-speed video camera. The exceptional properties of SiC (high melting temperature, good thermal conductivity and corrosion resistance) give the basis for studying the possibility to use it in core cladding reactor.

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