

Radiation from Relativistic Electrons in Periodic Structures "RREPS-23" & Electron, Positron, Neutron and X-ray Scattering under External Influences "Meghri-23"



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NEW MATERIALS FOR RADIATIVE APPLICATIONS

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New technologies invite researchers and developers to be creative, enabling them to consider theories and approaches which have thus far remained undeveloped. In our contribution we will introduce some considerations regarding involvement of new kind materials and possibility their dendrite structure to the research in field of physics of high-energy radiations.

First, we will consider several possible applications of currently commercially available single crystals of metals (e.g. [1]). We will share our preliminary research with aluminum (Al) single crystal and will discuss how we include experimental parameters of its texture to the realistic simulation of radiative processes using GEANT4 toolkit. Evaluation of Al single crystal use for the PXR generation will also be presented. Then, possible application of iridium (Ir) single crystal target for the effective generation of an intensive positron beam for future electron-positron colliders will be demonstrated.

At last, we will describe polycrystalline high-dendrite boron-enriched pyrolytic carbon (B-PyC) synthesized in our Institute in the in-house developed CVD facility [2]. The synthesis occurs on the inner surface of a cylindrical graphite assembly indirectly heated to the temperatures of 1450–1570 °C. Controlled low-density flows of nitrogen, boron trichloride, carbonaceous gases and low (0.01 to 2 % vol.) concentration oxygenic compound (e.g. water vapor or free air) react in the assembly and producing the B-PyC film characterized high concentration needle-shaped dendrites with highly extended surface. During the synthesis two-phase crystalline system is organized, that are hexagonal crystals of pyrolytic carbon and boron carbide B₄C. Outstanding properties of the pyrolytic carbon are widely known, e.g. [3]. Properties and possible applications of the polycrystalline high-dendrite B-PyC will be presented in more detail.

1. <https://mateck.com/en/content/7-metal-single-crystals>;
2. Demidenko M.I., Adamchuk D.V., Rusanov A.P., Sirotkin S.V., Ivanko L.V., Maksimenko S.A. Boron-enriched pyrolytic carbon: material for biomedical and engineering applications // Doklady of the NAS of Belarus, Vol. 67, No. 3 (2023) pp. 250–256 (in Russian);
3. A.W. Moore, Pyrolytic Carbon and Graphite, Encyclopedia of Materials: Science and Technology, Elsevier, 2001, Pp. 7933-7937.

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