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Structure, neutron scattering cross sections, and applications of fluorine-intercalated graphite

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Bragg scattering on a crystal is possible only if the wavelength of the radiation does not exceed the double distance between the crystal planes. Usually, in natural crystals, the interplane distance does not exceed ~ 2 Å, so neutrons with a wavelength of more than ~4 Å cease to scatter on them. It is due to this property that such neutrons are allocated to a separate group called cold neutrons. However, it is possible to create artificial crystals whose interplane distance can be several times greater. Usually, in the production of such crystals, a graphite single crystal is taken as a basis, and atoms of another substance are introduced between its crystal planes, which push the graphite planes apart. Thus, intercalated graphite is obtained, which can effectively scatter cold neutrons. However, such crystals are not sufficiently radiation-resistant to be used near the reactor core.

Not so long ago, the technology of embedding a whole plane (or two planes) of fluorine atoms between graphite planes appeared. Such a material seems promising as a cold neutron reflector, which can be used in strong fields of ionizing radiation. Preliminary results of structural studies and measurements of neutron scattering cross sections with such materials will be presented in the report.

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