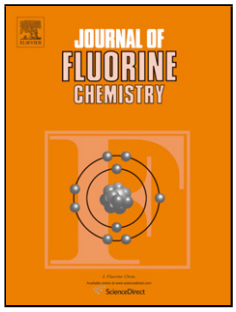

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Authors: Huali Wu, Francesco Carotti, Ruchi Gakhar, Nisarg Patel, Raluca Scarlat

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Fluorination of Nuclear Graphite IG-110 in molten 2LiF-BeF_2 (FLiBe) salt at 700 ºC

Huali Wu* University of Wisconsin – Madison, 1500 Engineering Drive, Madison, WI 53706, USA. huali@wisc.edu

Francesco Carotti University of Wisconsin – Madison, 1500 Engineering Drive, Madison, WI 53706, USA. carotti@wisc.edu

Ruchi Gakhar University of Wisconsin-Madison, 2525 Fremont Ave. Idaho Falls, ID 83415. Ruchi.gakhar@inl.com

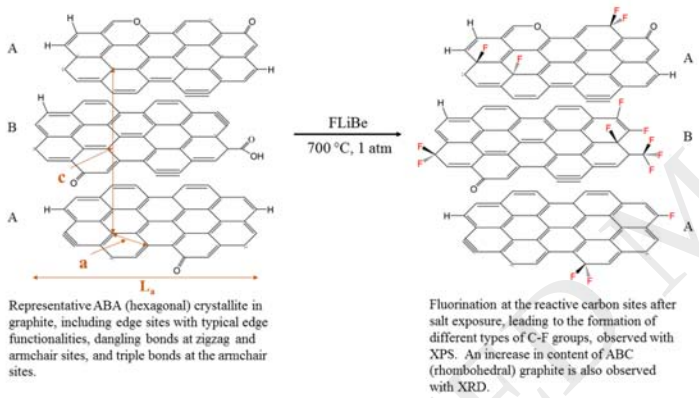
Nisarg Patel University of Wisconsin – Madison, 1500 Engineering Drive, Madison, WI 53706, USA. patel23@wisc.edu

Raluca Scarlat University of Wisconsin – Madison, 1500 Engineering Drive, Madison, WI 53706, USA. roscarlat@wisc.edu

*Corresponding Author. Tel: (+1) 979 676-3227. E-mail: huali@wisc.edu (Huali Wu). 1500 Engineering Drive, #927, Madison, WI, 53706. USA.

Dr. Ruchi Gakhar was a postdoc in Heat and Mass Group at UW-Madison when she worked on this project. Her current affiliation is Idaho National Lab and her current address email are provided in this manuscript.

Graphical abstract



Representative ABA (hexagonal) crystallite in graphite, including edge sites with typical edge functionalities, dangling bonds at zigzag and armchair sites, and triple bonds at the armchair sites.

Fluorination at the reactive carbon sites after salt exposure, leading to the formation of different types of C-F groups, observed with XPS. An increase in content of ABC (rhombohedral) graphite is also observed with XRD.

Highlights

- Interaction between nuclear grade graphite IG-110 and molten fluoride salt 2LiF-BeF2 (FLiBe) is studied at 700 □ and 1atm.
- C-F formation is observed from X-ray photoelectron spectroscopy (XPS), Raman Spectroscopy and X-Ray Diffraction (XRD) analysis
- Thermodynamic data shows that the fluoride salts reduction by graphite is not favorable.
- We postulate that the fluorination (covalent C-F bond formation) of the carbon atoms at functionalized or non-functionalized edge sites and defect sites drives the reduction of metal fluorides

ABSTRACT

It is important for the development of advanced nuclear reactors to understand if exposure to molten fluoride salts changes the physical properties of graphite and its ability to absorb tritium. The interaction between high purity nuclear grade graphite IG-110 and molten salt mixture 2LiF-BeF_2 (FLiBe) at 700 ºC for twelve hours in argon