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Moderate High Pressure X-ray Radiation-Induced Degradation of Persistent Poly- and Perfluoroalkyl Substances (PFAS)

August 2024

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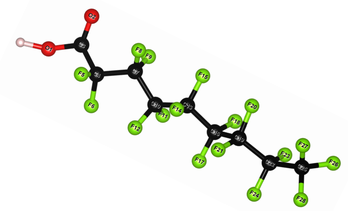

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Motivation

- PFAS are extremely chemically resistant compounds, leading to their accumulation and persistence in the environment.
- PFAS have been linked to physiological problems, including infertility and cancer, resulting in a national initiative to effectively destroy them.
- Current PFAS remediation technologies have not been effective. This project investigated the proof-of-concept of coupling high pressure (≤ 30 GPa) with ionizing radiation fields to enhance PFAS destruction.

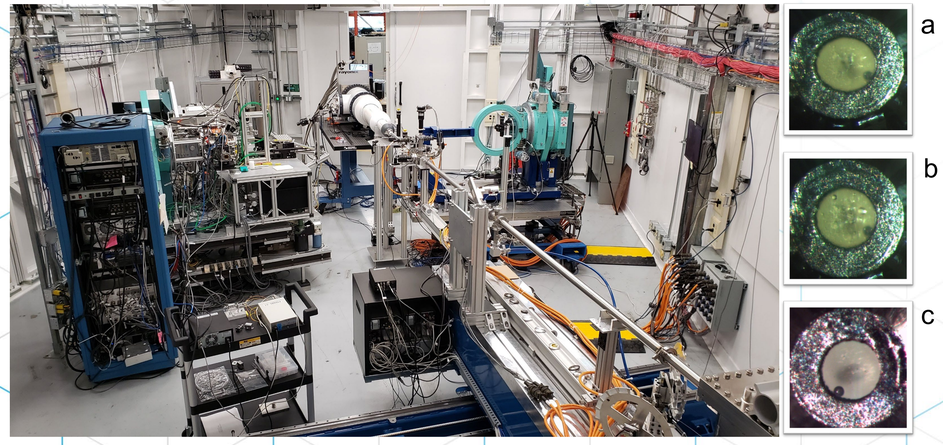

Fig. 1. Canadian Light Source (CLS) Brockhouse Diffraction Sector and Far Infra-red beamlines. *Inset:* Solid PFOA sample pressurized to 2 GPa **(a)**, irradiated for 1 hr with white X-rays, and decompressed to ambient pressure **(b)**, and finally opened revealing a liquid PFAS mixture **(c)**.

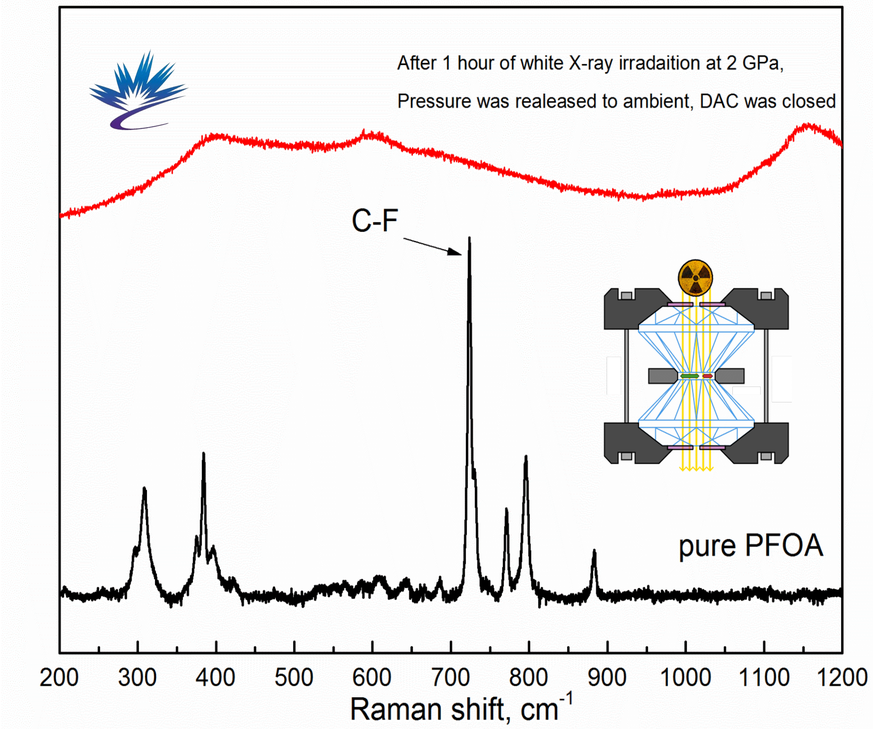

Fig. 2. Raman spectra (532 nm) of PFOA pressurized to 2 GPa in a Diamond Anvil Cell (DAC) before (**black**) and after CLS synchrotron x-ray irradiation (**red**) demonstrating radiation-induced molecular breakdown of perflurooctanoic acid.

Conclusions

- **High pressure in combination with x-ray irradiation afforded PFAS decomposition. Our proposed approach may be a viable method to break these ”forever chemicals” down into their constituents.**

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