

## Decomposition of Perfluoroalkyl Substances by Near-UV and Visible Light Irradiation to Semiconductor Nanocrystals

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Perfluoroalkyl substances (PFASs) and fluorinated polymers (FPs) have been extensively utilized in various industries, whereas their extremely high stability poses significant challenges, such as environmental persistence and waste treatment. Current decomposition approaches of PFASs and FPs typically require harsh conditions such as heating over 400 °C. Thus, there is a pressing need to develop a new technique capable of decomposing them under mild conditions. Here, we showcase a method wherein perfluorooctanesulfonate, known as a "persistent chemical," and Nafion, a widely utilized sulfonated FP for ion-exchange membranes, undergo efficient decomposition into fluorine ions under ambient conditions via the irradiation of incoherent visible LED light onto semiconductor nanocrystals (NCs).<sup>1)</sup> This decomposition reaction is driven by cooperative mechanisms involving light-induced ligand displacements and Auger-induced electron injections via hydrated electrons and higher excited states. This study not only demonstrates the feasibility of efficiently breaking down various PFASs and FPs under mild conditions but also paves the way for advancing toward a sustainable fluorine-recycling society.

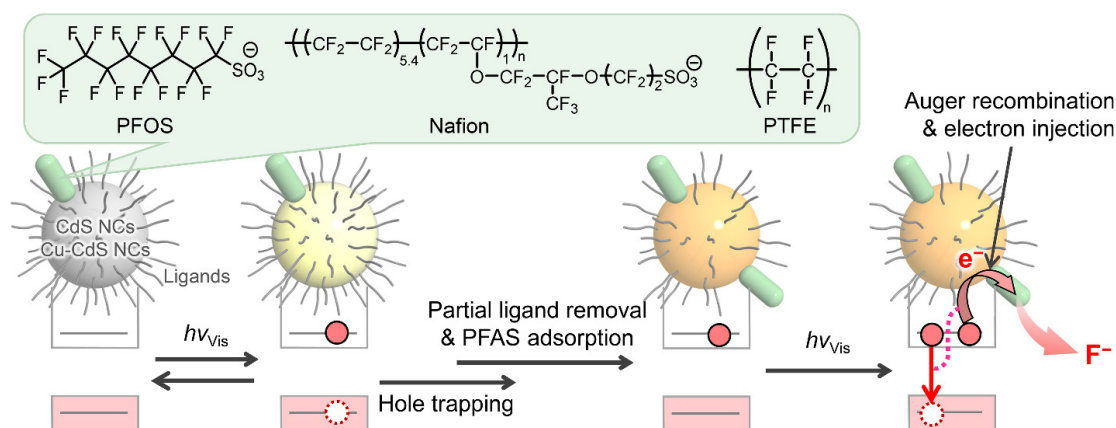


Figure 1. Plausible reaction mechanism of visible-light-induced defluorination of PFAS by semiconductor NCs.

1) Y. Arima, Y. Okayasu, D. Yoshioka, Y. Nagai, Y. Kobayashi, *Angew. Chem. Int. Ed.* **2024**, *63*, e202408687.