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Fast polymeric functionalization approach for the covalent coating of MoS_2 layers[1]

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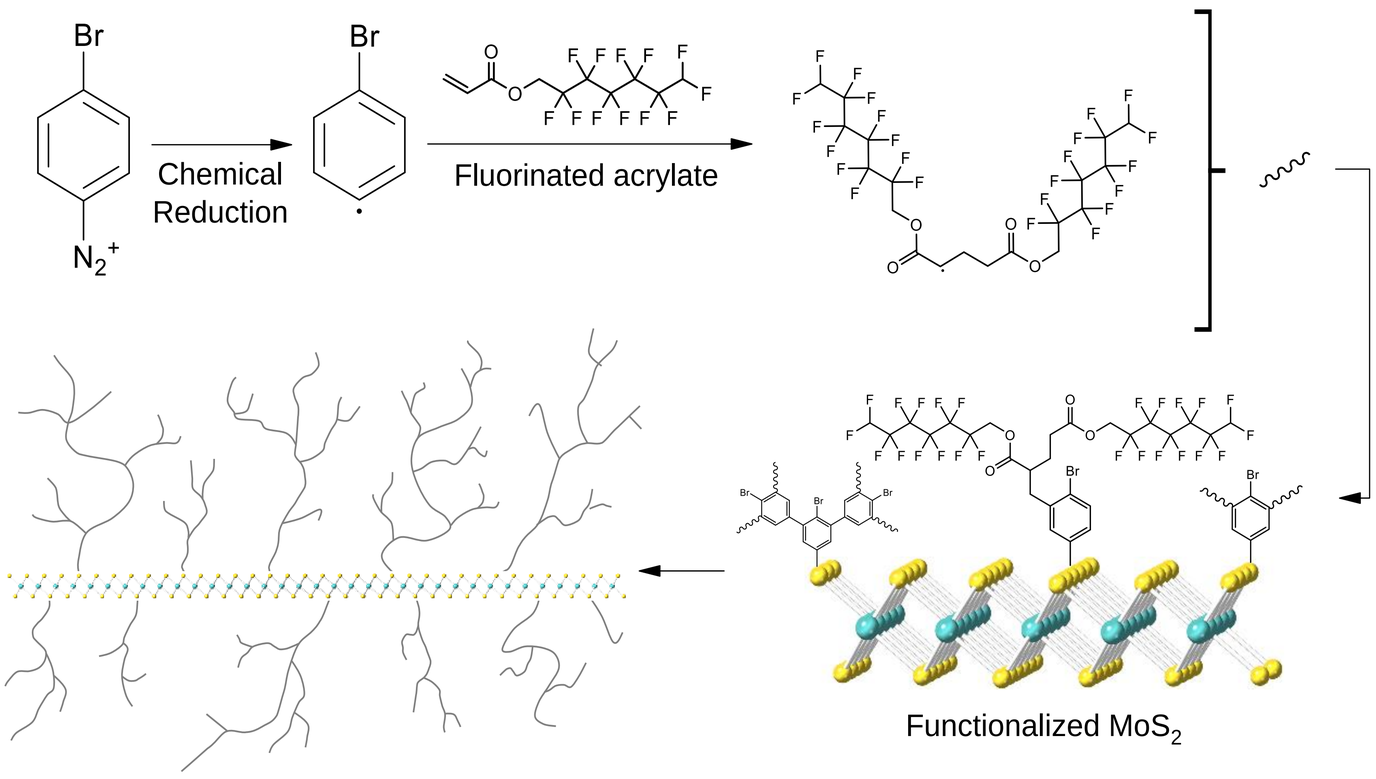
Herein we present a versatile polymeric reaction for the covalent functionalization of chemically exfoliated molybdenum disulfide (**CE-MoS_2**)[2] with a desired functional shell. We take advantage of the robust covalent **diazonium** grafting occurring via aryl radicals to promote the polymerization of functional **vinyl/acryl monomers**.[3] As a result, MoS_2 is coated with a large number of functional moieties with **any desired functionality**, depending on the selected vinyl monomer.

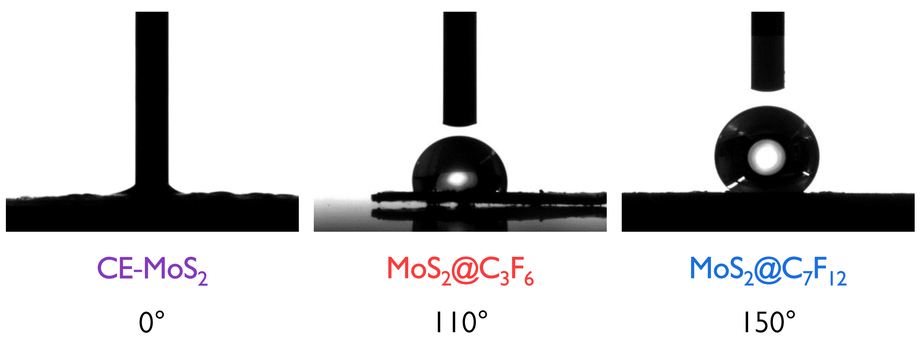
In this work, functional acryl monomers comprising hydrophobic groups were selected, which serve as the basis to develop air-stable and more processable functional polymer-coated 2D materials

The reaction

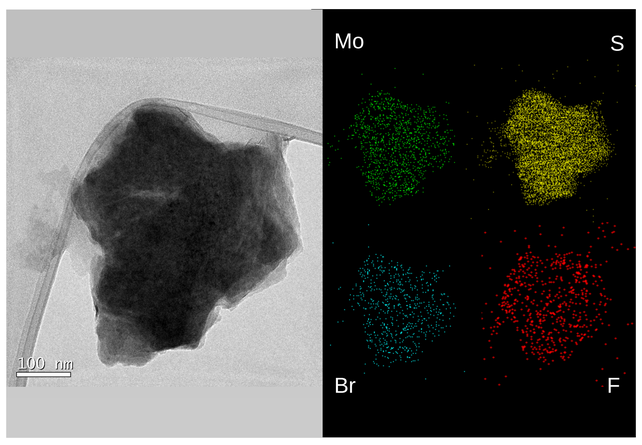


Diazonium reduction takes place upon electron transfer from the metallic 1T-MoS_2 to form a first phenylene layer, which acts as the base for the radical growth of vinyl polymers formed in situ.

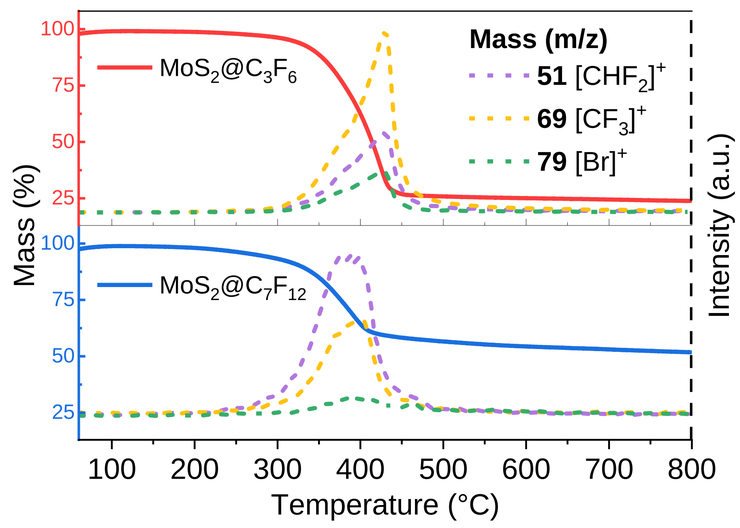
Hydrophobic coating



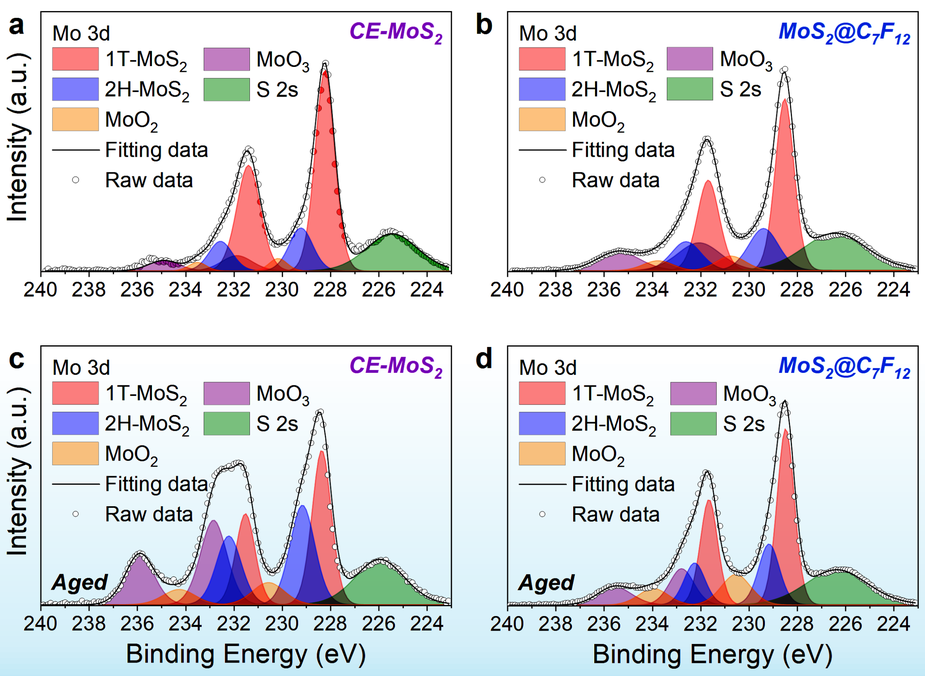
TEM images



TGA-MS



Oxidation prevention



CONCLUSIONS

We have successfully applied a diazonium anchoring reaction to provoke the covalent adhesion of functional polymeric coatings onto CE-MoS_2 flakes. The presence of the functional groups was revealed by EDX and TGA-MS. The large hydrophobic behaviour, evidenced by **contact angle measurements**, improves the air-stability of the 2D material, as proved by XPS measurements on **7-month-aged samples**. This property would open the door to its use in practical devices operating at ambient conditions.

We anticipate that the reported chemical functionalization may be applied using practically **any acrylate molecule** to form functional polymeric coatings with strong interfacial bonding between the organic functional matrix and the CE-MoS_2, which significantly expands the possibilities of the 2D material for numerous applications.

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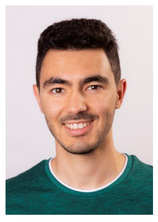

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