



## Advice note 2 – NanoFATE has confirmed a need for case-by-case consideration (not necessarily full scale testing) of coating effects on NP behaviour and toxicity.

### Advice notes to answer the big five questions

NanoFATE has identified five “Big Questions” important to our understanding of the ecotoxicology of engineered nanoparticles and will help provide key information required to assess the risk that these materials may pose to the environment.

This advice note is in response to the question:

**What effects do coatings have on fate, behaviour & toxicity?**

### Summary of Findings

As part of the work of NanoFATE we have reviewed the role particle properties, including coatings, play in determining the environmental fate, bioavailability and ecotoxicology of engineered nanoparticles (ENPs). The following bullet points summarise our conclusions in relation to the effect of coatings on these ENP properties.

- Even NPs with the same core material may exhibit a range of behaviours, depending on factors such as coating material, shape, and size.
- The presence of a surface coating on manufactured NPs may significantly modify their surface chemistry, compared with the uncoated equivalent.
- The presence of nonwater-soluble surface coatings increases the thermodynamic stability of ENPs and are likely to restrict their chemical dissolution.
- In the absence of a surface coating, metal-based NPs have charged surfaces resulting from the presence of hydroxyl (–OH) groups that can take up and release protons, and can take up dissolved chemical species such as metal ions and ligands.
- The sign and magnitude of the surface charge will be determined by the intrinsic chemistry of the surface groups and the chemical composition of the solution, in particular the pH and the concentrations of binding species.
- Although specific functional coatings may be applied to metal-based NPs during manufacturing, sorption of ions such as humic substances may occur in the environment, potentially involving partial or complete replacement of any manufactured coating.

### More information

These conclusions are discussed more fully in our public summary “[D4.3 Research report and associated research paper addressing the current state-of-the-art in analysis of ENP property effects on toxicity property–effect relationships.](#)”, and in the paper in [Environmental Toxicology and Chemistry, Vol. 31\(8\), pp. 1679-1692.](#)