

# Transition Metal Ions Uptake from Aqueous Solutions by Graphene Oxide

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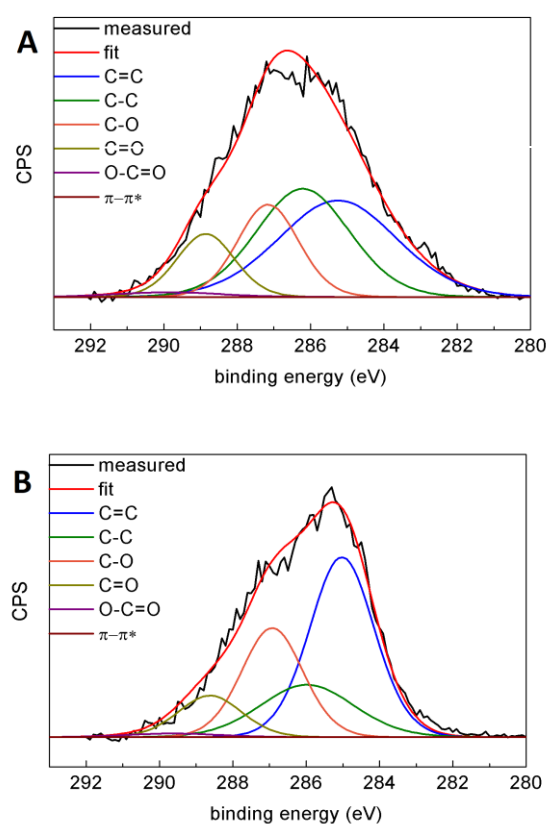
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It is known that transition metal ions pose a high risk to both ecosystems and humans. A considerably high amount of these ions are generated in industrial effluent, agricultural drainage and also in the acidic leachate from landfills. Therefore, the major challenge is to find the most effective method for removing unwanted metal residues from wastewaters. Graphene oxide has a wide potential to be used in environmental applications, due to its high surface area (up to  $2630 \text{ m}^2 \cdot \text{g}^{-1}$ ) and also thanks to oxygen-containing functional groups (eg. ketone, epoxide, hydroxide and carboxyl) that can be found on the surface of graphene oxide.[1] Metal ions can be bonded by these groups by coordination bonding or by electrostatic powers. Graphene oxides used in this work were synthesised by the Hummers method and Hofmann method.[2,3] Deconvolution of the high resolution XPS spectra of C 1s peak was used to determine the amount of oxygen-containing functional groups at starting materials (figure 1). We showed that both graphene oxides have 10–30 times higher sorption capacity than common sorbents and that, in the most cases, Hummers graphene oxide had a higher sorption capacity than Hofmanns graphene oxide. The sorption capacity was tested for the most of the ions stable in aqueous solutions (from lithium up to bismuth) showing several trends within sorption capacity related to the ion valence, polarisation power and electronegativity as well as structure of coordination sphere.

## References

- [1] Geim, A. K.; Novoselov, K. S. *Nat. Mater.* 6 (2007), 183-191.
- [2] Hummers W., and Offeman, R. J. *Am. Chem. Soc.*, 80 (1958), 1339.
- [3] Hofmann, U. and Frenzel, A. *Kolloid-Z.*, 68 (1934), 149–151.

## Figures



**Figure 1:** Deconvolution of the high resolution XPS spectra of C 1s peak of Hofmanns graphene oxide (A) and Hummers graphene oxide (B).