

Making nanomaterial inks from insoluble rocks- a personal journey

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In this talk, I will review my personal scientific journey which began during my PhD time at the University of Erlangen-Nürnberg in 2007, i.e. at a time, when single-walled carbon nanotubes were intensely investigated worldwide. These nanomaterials consist of an all sp^2 carbon framework just like graphite, but rolled up into hollow cylinders. Depending on the way they are rolled up, they have different electronic properties, e.g. metallic or semiconducting. This completely fascinated me and I found my first scientific love. Since they are insoluble rocks, I worked on efficient ways to “solubilize” them and then potentially separate them.

During this time, it also became clear that a single layer of graphite termed graphene is yet another high potential wondermaterial so that a lot of research activities moved from nanotubes to the two-dimensional (2D) objects. Here, similar problems arise: the abundant starting point to 2D materials are natural stacks of the layers - which are again insoluble rocks. However, using the learnings from carbon nanotubes, it was demonstrated by a team of researchers at Trinity College Dublin, that individual layers of graphite can be peeled off to produce graphene in a process now termed liquid phase exfoliation.

Even though I had already been working in science administration at the Cluster of Excellence “Engineering of Advanced Materials”, I was fascinated by this development and strongly encouraged by the people in my environment to do a postdoc. I therefore joined the researchers in Dublin in 2012 on the exciting quest to optimize and understand this exfoliation process in liquids. Some of our research activities today still focus on fundamentally understanding the mechanism of the material production. While working in Dublin, 2D materials in general were more and more in the scientific spotlight, as many materials are layered and can be exfoliated in similar ways. This extremely rich playground of materials is the origin of a hype that now lasts well over a decade. In my career development, I strongly benefitted from this and all opportunities that came with it.

In 2015, I established my independent junior research group at Heidelberg University and became Chair Professor at Kassel University in 2021 focusing on exfoliation, processing, characterisation and chemical modification of a range of 2D materials.

