6th World Conference on
Advanced Materials, Nanoscience and Nanotechnology
October 21, 2024 | Amsterdam, Netherlands
https://doi.org/10.62422/978-81-974314-2-5-004

Revisiting the Influence of Metal Impurities and Structural Defects on the Intrinsic Paramagnetism of Graphene Oxide (Go).

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GO-based materials have recently attracted substantial attention in the biomedical field as effective contrast agents (CAs) in Nuclear Magnetic Resonance Imaging (NMRI). This study focuses on the importance of understanding the interplay between metal contaminants and structural defects on the paramagnetism of GO (Fig. 1).

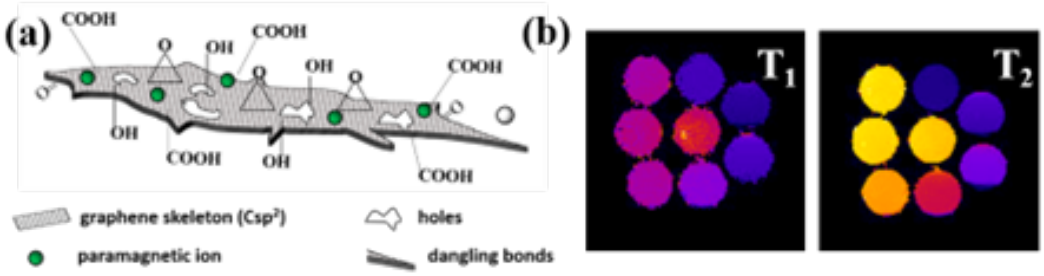

Figure 1. (a) A simplified diagram of the GO structure, containing the different oxygenated groups (hydroxyl, epoxy, and carboxyl), defects (holes, dangling bonds), and metallic contaminants, and (b) MRI of GO water solutions: T1 and T2 coloured maps, adapted from [1].

A combination of techniques, including morphology analysis, chemical composition evaluation, elemental analysis, various spectroscopies, and imaging, was employed to verify and quantify the presence of trace metal impurities and structural defects within the nanomaterial. Notably, X-band Electron Paramagnetic Resonance (EPR) and 1.0 T MRI measurements were utilized to confirm that the primary source of relaxivities in pristine GO nanosheets is structural defects, sometimes identified as dangling bonds. The results underscore the potential of GO as a versatile platform for developing advanced MRI contrast agents, paving the way for enhanced diagnostic capabilities in medical imaging and targeted therapies.

[1] G. Fioravanti et al. "Disentangling the intrinsic relaxivities of highly purified graphene oxide." (2024) Nanotechnology, 35(24), 245101. DOI: 10.1088/1361-6528/ad3253

Biography:

Graduated in chemistry at the University of Rome "La Sapienza" cum laude, I obtained my PhD in Materials Engineering, working on the preparation and characterization of materials for applied electrochemistry. I worked as a researcher at the University of Bologna dealing with synthesis and study of benzylamide Rotaxanes. Since 2008 I am a researcher at the University of L'Aquila, where I also teach "Chemistry" for Engineering and "Chemistry of Surfaces and Interphases" for Chemical Sciences. My research interests are surface modification and preparation and characterization of Graphene Oxide-based materials for nanotechnological applications.