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The first observation of memory effects in the infrared (FT-IR) measurements: Do successive measurements remember each other?

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Abstract

Over the past couple of decades there have been major advances in the field of nanoscience and nanotechnology. Many applications have sprouted from these fields of research. It is essential, given the scale of the materials, to attain accurate, valid and reproducible measurements. Material properties have shown to be a function of their size and composition. Physiochemical properties of the nanomaterials can significantly alter material behavior compared to bulk counterparts. For example, metal oxide nanoparticles have found broad applications ranging from photo-catalysis to antibacterial agents. In our study, we synthesized CuO nanoparticles using well established sol-gel based methods with varying levels of Ni doping. However, upon analysis of measured infrared data, we discovered the presence of quasi-periodic (QP) processes. Such processes have previously been reported to be tightly associated with measurement memory effects. We were able to detect the desired QP process in these measurements from three highly accurate repetitive experiments performed on each Ni (1-7%) doped CuO sample. In other words, successive measurements performed in a rather short period of time remember each other at least inside a group of neighboring measurements.

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