

Measuring the temperature of nanoparticles

November 30 2010

One of the holy grails of nanotechnology in medicine is to control individual structures and processes inside a cell. Nanoparticles are well suited for this purpose because of their small size; they can also be engineered for specific intracellular tasks. When nanoparticles are excited by radio-frequency (RF) electromagnetic fields, interesting effects may occur. For example, the cell nucleus could get damaged inducing cell death; DNA might melt; or protein aggregates might get dispersed.

Some of these effects may be due to the localized heating produced by each tiny nanoparticle. Yet, such local heating, which could mean a difference of a few degrees Celsius across a few molecules, cannot be explained easily by heat-transfer theories. However, the existence of local heating cannot be dismissed either, because it's difficult to measure the [temperature](#) near these tiny [heat](#) sources.

Scientists at Rensselaer Polytechnic Institute have developed a new technique for probing the temperature rise in the vicinity of RF-actuated nanoparticles using fluorescent [quantum dots](#) as temperature sensors. The results are published in the *Journal of Applied Physics*.

Amit Gupta and colleagues found that when the nanoparticles were excited by an RF field the measured temperature rise was the same regardless of whether the sensors were simply mixed with the nanoparticles or covalently bonded to them. "This proximity measurement is important because it shows us the limitations of RF heating, at least for the frequencies investigated in this study," says

project leader Diana Borca-Tasciuc. "The ability to measure the local temperature advances our understanding of these nanoparticle-mediated processes."

More information: The article, "Local Temperature Measurement in the Vicinity of Electromagnetically Heated Magnetite and Gold Nanoparticles" by Amit Gupta, Ravi Kane and Diana-Andra Borca-Tasciuc appears in the *Journal of Applied Physics*. See: link.aip.org/link/japiau/v108/i6/p064901/s1

Provided by American Institute of Physics

Citation: Measuring the temperature of nanoparticles (2010, November 30) retrieved 23 April 2024 from <https://phys.org/news/2010-11-temperature-nanoparticles.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.