Title: Nanoprobes for high resolution spatial and temporal temperature mapping

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Temperature is important in controlling the chemical and physical properties in a wide range of systems. Especially, in the field of catalysis this is the case, since product formation strongly depends on temperature. Therefore, an accurate thermometer is of key importance in catalysis research. However, on the (sub-) micrometer scale the size of the thermometer often is a limiting factor in realizing spatial resolution. A promising technique to overcome this problem is nanothermometry, in which nanoparticles (NPs) doped with lanthanide ions, e.g. Er^{3+}, act as temperature sensors.

Luminescence from thermally coupled states in these ions follows Boltzmann behaviour. Consequently, illumination of these lanthanides followed by spectral or lifetime analysis enables accurate determination of the temperature. Using chemically inert NPs as host matrix, the resolution of this technique can be extended to the (sub-)micrometer scale and probe the actual temperature at the positions of the NPs.

Combining nanothermometry with confocal fluorescence microscopy enables visualization of the temperature in relevant chemical systems like single catalyst particles and *in situ* TEM heating systems. Using 3D temperature mapping, new insights on the activity of a catalyst and temperature distributions in the heating systems can be obtained.