New Strategies for Luminescence Thermometry and Manometry

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Optical pressure and temperature sensors, i.e., luminescent manometers and thermometers, offer new possibilities for remote and non-invasive investigation and monitoring of changes in physicochemical and spectroscopic properties of materials under extreme conditions. This can be done by monitoring and analyzing selected spectroscopic parameters, such as band intensity ratio, emission line shift, or luminescence decay times. However, the limitation for optical readouts is usually the quenching of the luminescence signal in a given material, i.e., in the active part of the sensor under high pressure or temperature conditions.

Here we show some new, promising strategies for the development of advanced and ultrasensitive pressure and temperature sensors, based on organic and inorganic materials containing lanthanide and d-block metal ions. The factors affecting the enhancement of luminescence signal intensity and sensor sensitivity will be discussed. These goals can be achieved through inter-ionic energy transfer, temperature/pressure-induced intersystem configurational crossover, increased light-to-heat conversion efficiency in a vacuum, by simultaneous use of parametric and non-parametric processes, and by using materials exhibiting both photo- and mechano-luminescence. [1-5]

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