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# LiF – a spectroscopic method for rare earth elements identification

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Laser-induced fluorescence (LiF) has a great potential for the exploration and identification of rare earth elements (REE) in natural environments. This spectroscopic technique can provide an efficient way to secure resource availability, while the economic and ecological costs are reduced. No time-consuming sample preparation and analysis is needed prior to decisions along the raw material processing chain. Such non-destructive approaches allow for a fast access to analytical results and hence, are the basis for an immediate adjustment of processing steps.
The method uses the material-specific luminescence emissions that are induced by laser-stimulation of a certain wavelength. The distinct emission lines of REE make them well suited for the development of a LiF-based exploration technique. However, typical REE emission peaks known from the free elements may shift or be masked in natural materials due to their position in the crystal lattice, varying compositions of minerals or other natural conditions such as water content. The natural variability therefore, demands for comprehensive investigations of REE and their spectral characteristics in minerals.
To identify those spectral information that are robust and unequivocal, we analyse spectra of REE standards measured in different matrix minerals including phosphates and fluorides. We use variable laser wavelengths from UV (325 nm) to green (532 nm) and a detection range from 340 nm to 1080 nm. Results show spectral characteristics that sort REE in three groups due to: no distinct emission lines, absorption features, distinct luminescence emission lines. Measured in different matrix minerals, we determine shifts for some of the spectral features and some disappear or decline in intensity. Changing the wavelength of the laser allows for a more selective stimulation of REE emissions, especially wavelengths longer than UV can reduce the unspecific emission of all luminescent components of a sample and thus enhance individual spectral information. To test the applicability of LiF, we additionally investigated natural rocks with a well-characterized REE content. First results show that LiF is able to reproduce spectral characteristics of REE in natural rocks.