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H/D exchange in clays by real-time infrared spectroscopy

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The vibrational spectroscopy of the O-H bond is of paramount importance in the characterization of clay minerals and clay-based materials, because it provides intrinsic proxies that are specific to the octahedral sheet, the termination of the tetrahedral sheet, the layer charge, the contents of the interlayer etc. As H₂O is an essential part of the clay structure and a determinant of its properties, data acquisition ought to be non-invasive and able to accommodate variable hydration.

H/D exchange, monitored in real-time under controlled hydration conditions, is an elegant tool for determining the accessibility of the various OH species in addition to enhancing their resolution. This talk presents briefly the instrumentation needed for this type of work in the mid- and near-infrared and reviews relevant case studies from own research. Examples include the separation of the structural OH and H₂O in palygorskite/sepiolite (Bukas et al. 2013) and smectite (Kuligiewicz et al., 2015a), the latter leading to a method for determining layer charge (Kuligiewicz et al., 2015b; Tsiantos et al. 2018). New results about the interlayer accessibility of kaolinite, intercalated kaolinite and halloysite will be also presented.

References

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