

# Photoinduced dynamics of transition metal complexes. ...vibrations tell the tale.

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For decades, infrared (IR) spectroscopy has been a valuable tool to elucidate the static structure of molecules – in the gas phase, in liquid solution, or in solid matrices. When carried out with pulsed electric fields, it becomes even more powerful because it gives direct access to the dynamic evolution of the structure of molecules, either at thermal equilibrium or in response to an external stimulus, e.g. a photonic excitation.[1] Time-resolved IR-spectroscopy can be conducted in distinct modes of operation thereby giving access to time scales from tens of femtosecond to hundreds of seconds.

Here, we will report on the utility of these techniques in studies of the photochemistry of transition metal (TM) complexes. If time permits, we will touch on two specific topics:

(i) TM-carbon dioxide binding: using ligand-to-metal charge transfer excitation of TM-oxalates, CO<sub>2</sub> complexes can be prepared *in situ* and information about their molecular structure can be obtained when the experimental time-resolved IR-data are combined with electronic structure calculations.

(ii) TM-nitrides and nitrenes formation: electronic excitation of late TM-azides yields non-isolable terminal nitrido and nitreno complexes through dinitrogen cleavage. Despite their fleeting nature, the chemical reactivity of these species can also be explored in intricate quenching studies.

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