Microscopic Origins of the Radiative Heat Transfer - Spectral Emissivity of Dielectric Oxides

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Dielectric oxide compounds are of great interest for high temperature processes. The knowledge of their radiative properties is very important to lay out new machines or to enhance existing devices for a better energetic efficiency. Industrial activity is concerned as in glass production, nuclear plants, aerospace domain, and more generally every application involving thermal barrier protections. More fundamental domains are also connected such as physics of condensed matter (phase transformation, order/disorder), or geosciences (thermal behavior of magmas)… The contactless temperature measurement at high temperature is also more accurate with a good knowledge of the microscopic origins of the radiative heat transfer. This contribution will present some state of the art of the experimental tools to measure this parameter within semi-transparent samples as a great number of oxides. We will show that the measured spectral emissivity associated with the proper model allows finding the optical parameters from experimental spectra. Some examples will be given to illustrate the radiative response of oxide compounds and the behavior versus temperature will be discussed in their solid and liquid states up to 2500K. The microscopic mechanisms, responsible of the thermal emission, could be resumed by the structural and dynamical properties of atoms or molecules in the matter for homogeneous samples and in taking into account morphology of heterogeneities for other samples. Such an approach is the way to have a direct action on the elaboration of new samples to change the property and/or to influence the radiation contribution to the heat transfer.