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Plasma-assisted processes for the production & utilization of energy carriers

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Plasmas are basically ionized matter. In the last years, their use in chemical processes has been considered as a pathway for electrification and intensification, since they can be generated using renewable electricity and can lead to a substantial increase in product yield/efficiency. Comprising a complex mixture of free electrons, charged ions and neutral species, plasmas have been also successfully used in combination with catalytically active solid surfaces. However, these plasma-catalytic processes are still at a very early stage of development and the mysteries behind the synergy need to be unveiled. Plasma-assisted and plasma-catalytic processes can moreover play a key role in our transition to a carbon-neutral future. They have been applied to sluggish and highly energy-demanding reactions leading to the synthesis of chemical energy carriers such as CH_4 and NH_3 , together with their utilization for delocalized hydrogen and or electricity energy generation (on-demand). In this seminar, the importance of tailoring the physicochemical and dielectric properties of the catalyst used in plasma-assisted processes will be highlighted. The type and features of the plasma used in these processes, the reactor design and the transport phenomena involved, are as well essential aspects that must be considered in view of a future scale up and towards the practical implementation of plasma-assisted processes.