Optimising aerospace materials and processes: a few use cases of artificial intelligence

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The development of new aerospace materials for structural or functional purposes is especially important at a time when material requirements, regulations, and socio-economic expectations are becoming increasingly stringent. The reduction of pollutant emissions has indeed become a strategic industrial challenge. Current needs can be generally summarised as the improvement of the high-temperature specific properties of materials, which is key to reducing the mass of both the propulsion system and the aircraft itself.

This presentation will provide an overview of several projects aimed at developing new alloys based on nickel, titanium, or aluminium for use in gas turbine applications. The inherent complexity of these developments will be introduced: in service, these materials are exposed to high temperatures, severe mechanical loads and aggressive environments. The optimisation of their composition, or of their processing parameters, is a search for compromises and relies on predictive thermodynamics and machine learning to describe the composition–microstructure–property relationship. The limitations of such an approach, including the limited availability and heterogeneity of data, will also be discussed. Finally, some perspectives on methodological improvements, including the use of deep learning, will be presented.