

Development of high temperature materials and simulation methods

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High temperature materials such as nickel-base superalloys and near-alpha titanium alloys are used in the compressor and/or the turbine of a jet engine. Increasing the temperature capability of these alloys leads to an improvement in the thermal efficiency of the jet engine, which results in a reduction of CO₂ gas emission and fuel consumption. Therefore, the development of materials with high temperature capabilities is sought by engine makers and airlines. In order to design and develop new alloys which meet the requirement of engine makers and airlines, it's necessary to consider various properties such as creep strength, yield strength, oxidation resistance, low-cycle fatigue, etc. However, it's complicated and time-consuming to develop these alloys for practical use because they are multicomponent alloys which contain six to ten elements. In order to develop such complicated alloys, numerical simulations are essential. I have carried out modeling and development of nickel-base superalloys and near-alpha titanium alloys. In this talk, I will introduce my recent work on this topic.