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SUMMARY

Recent initiatives for fuel flexibility, increased efficiency and decreased emissions in power generating industrial gas turbines (IGT's), have highlighted the need for the development of techniques to produce large single crystal Ni-base superalloy turbine blades and vanes. In order to address the technical difficulties of producing large single crystal components, a program has been initiated to, using computational materials science, better understand how alloy composition in potential IGT alloys and solidification conditions during processing, effect castability, defect formation and environmental resistance. This program will help to identify potential routes for the development of high strength, corrosion resistant airfoil/vane alloys, which would be a benefit to all IGT's, including small IGT's and even aerospace gas turbines. To date, collaboration with Siemens Westinghouse Power Corporation (SWPC) and Solar Turbines has identified about 50 alloy compositions that are of interest for this potential application. Several visits to SWPC have been taken by the student working on this project to utilize computational software at SWPC to evaluate the 50 alloy compositions. From these preliminary results, 5 alloys have been selected for processing of small arc-melted buttons to compare experimentally determined phase transformation temperatures and volume fractions to the calculated values. The results of this comparison, which are expected within the next months, will be used to help identify 3-5 alloy compositions for processing to produce single crystal samples. This program is also a unique opportunity to train graduate and undergraduate students in the field of high temperature materials and to stimulate industrial/university interaction.