Contribution ID: **48** Type: **not specified**

Ab initio alloy design for C-band accelerators

Wednesday, 21 April 2021 08:30 (30 minutes)

The development of novel copper alloys with increased breakdown limits is crucial for the design of higher energy and more compact accelerators that operate at lower cost. Adding solute atoms in copper is a promising strategy to improve the breakdown limits, as solute strengthening can improve mechanical properties by limiting the plastic deformation under thermal loading. However, thermal stresses induced by RF dissipation are also increased by adding solute atoms, which is the driving force for plastic deformation. In this talk, I will present our progresses in ab-initio copper alloy design for C-band accelerators. We are using a figure of merit (FOM) based on the ratio of these two factors to screen dilute copper alloys on the periodic table. After computing FOMs of all the alloys, we will select the best copper alloys and determine the solute concentrations that can improve breakdown limits of copper. These results are important to guide the design of C-band accelerators.

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Session Classification: Session 6