

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Segmentation of 9Cr Steel Samples based on Composition and Mechanical Property. NARAYANAN KRISHNAMURTHY, SIDDHARTH MADDALI, ORAU NETL Pittsburgh, ROMANOV VYACHESLAV, NETL Pittsburgh, JEFFREY HAWK, NETL Albany — Data mining approaches were used to look at composition-process-property linkage in 9Cr steel. We present results of cluster identification using 7 principal composition elements and analyze its significance with respect to mechanical tensile properties. Data set comprises 82 compositional variants of 9Cr steel whose Cr weight fraction ranges 8-13%. The alloys underwent heat treatments (homogenization, normalization, and 1 to 3 tempering cycles) and were tested for tensile and creep properties at room temperature and elevated temperatures (427/800 oC median/max). In this study, alloys were partitioned into groups, and their mechanical properties were analyzed for significant differences across groups. Normalized weight fractions were used to delineate groups of alloys. Partitioning Around Medoids (PAM) clustering was used, with dissimilarities instead of distance metrics. Dataset of 21 chemical components, with Fe being the majority component, followed by Cr and C. Major contributors of composition to PAM clustering were obtained from PCA scores. Mean ultimate tensile strength of segmented groups of alloys was analyzed with ANOVA & Tukey HSD tests to identify the final 3 groups based on composition and mechanical property.

Narayanan Krishnamurthy
ORAU NETL Pittsburgh

Date submitted: 22 Nov 2016

Electronic form version 1.4