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NASA TECH BRIEF

Microprobe Investigation of Brittle Segregates in Aluminum MIG and TIG Welds

Quantitative microprobe analysis was used to determine the composition of segregated particles in aluminum MIG (Metal Inert Gas) and TIG (Tungsten Inert Gas) welds. Because of the complexity of the system, i.e., six-element phases of small, irregular shapes, it was necessary to critically review quantitative microprobe techniques. Although requiring tedious calculations, quantitative corrections related to instrumental factors, absorption, fluorescence and atomic number effects were applied. A relatively large number of particles were analyzed to make the results statistically acceptable. Error sources were analyzed, and the results were viewed in relation to the experimental difficulties and analytical inaccuracies present. The results indicated that there were about ten different kinds of particles, corresponding to ten different (binary, ternary, and quartenary) intermetallic compounds. In some cases, it was possible to analyze the compositions into subgroups within each type of intermetallic component. A majority of the particles could be accounted for by one intermetallic compound only. The rest were accounted for by a combination of two intermetallic compounds. Differences between MIG and TIG welds were observed. Only in the MIG welds were binary $CuAl_2$ observed. Also, copper-rich phases tended to be more frequently located in the MIG welds. Metastable ternary phases were found more frequently in the TIG weld. The differences between the MIG and TIG welds appear to be related to the individual cooling rates of these welds.

Note:

Details may be obtained from:

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No patent action is contemplated by NASA.

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Category 03