

Failure Mode Analysis of a Multiple Layer Explosion Bonded Cryogenic Transition Joint

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Abstract : In cryogenic liquefaction processes, brazed aluminum core heat exchangers are used to minimize surface area/volume of the exchanger. Aluminum alloy (5083-H321; UNS A95083) piping must transition to higher melting point 304L stainless steel piping outside of the heat exchanger kettle or cold box for safety reasons. Since aluminum alloys and austenitic stainless steel cannot be directly welded to together, a transition joint consisting of 5 layers of different metals explosively bonded are used. Failures of two of these joints resulted in process shut-down and loss of revenue. Failure analyses, FEA analysis, and mock-up testing were performed by multiple teams to gain a further understanding into the failure mechanisms involved.

Keywords : explosion bonding, intermetallic compound, thermal strain, titanium-nickel Interface

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