In-Situ TEM Observation of Intermetallic Phase Growth in Al-Steel Clad Sheet

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Abstract. Aluminum-steel clad composites are used as structural elements in car bodies and chases as well as in the chemical industry due to a combination of high strength of steel, low density of Al and high corrosion resistance of both materials. An important parameter influencing mechanical properties of the composite is the microstructure of the bonding region between Al and steel layer. During manufacturing of the final product, clad sheets can be subjected to elevated temperatures which enhance diffusion between the metals. As a result, a brittle intermetallic phase, deteriorating the bond strength between steel and aluminum, forms at the interface. This paper focuses on study of the interfacial microstructure in a twin-roll cast Al-steel clad strip and its evolution during in-situ annealing in transmission electron microscope. Due to isochronal annealing above 500 °C, Al_5Fe_2 phase forms at the interface. Nucleation centers formed at the beginning of heating experiment expand and form continuous layer. The kinetics of the growth follows the parabolic law typical for diffusion-controlled phase transformations.