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Aluminium is extensively used as a structural material due to its excellent strength to weight ratio and corrosion resistance properties. The surface of aluminium under normal conditions has a thin oxide film (1-10nm) which provides corrosion resistance. However due to lower thickness, flaws and heterogeneity of native oxide layer does not provide long time corrosion resistance and adhesion of organic coating for a particular function in different environments. In order to enhance the corrosion resistance and adhesion of organic coating, the aluminium native oxide layer is treated to transform or convert to a functional conversion coating. In the last several decades chromate conversion coating (CrCCs) have been the most common conversion coatings used for aluminium alloys. Due to the toxicity of the hexavalent chrome, however, environmental friendly alternatives to CrCCs have been investigated extensively. Despite the intense research no equivalent substitute for (CrCCs) has been found. For these reasons, alternative conversion coatings are sought for substituting existing ones.

Aluminium alloys AA 1090, Peraluman 706, and AA 6060 were subjected to high pressure steam treatment and various chemistries based on pH and oxidizing capabilities. Treatment is carried out in an autoclave at a temperature of 110 – 112 °C and pressure of 5 Psi for varying times. The growth and composition of the oxide layer was investigated in detail as a function of microstructure using GD-OES, FEG-SEM, EDX, FIB-SEM, XRD, and FTIR. Potentiodynamic polarization measurements and acid salt spray testing were used to study the corrosion behavior of the produced coatings. In average, thickness of the oxide layer formed was increased to ~1-1.5 µm with steam treatment and various chemistries, and the coverage on the surface was dependent on the microstructure of the alloy, particularly the composition of the intermetallics. Mechanism of the coating formation will be elucidated.