The replacement of chromate conversion coatings is nowadays an important issue in aerospace and automotive industry. ZrO₂ coatings have already been proved to be potential candidates for the substitution of Cr(VI) containing coatings combining barrier protection and paint adhesion. However this kind of coatings lacks a capacity of “active” protection.

Our research approach considered the development of thin ZrO₂ coatings by means of sol-gel technology for aluminium alloys (AA2024, AA6061 and AA7075). ZrO₂ films were deposited employing Zr-based aqueous solutions combined with different organic inhibitors in order to provide a certain degree of “active” protection. Coating application was carried out by different deposition approaches at a laboratory scale. Morphology of ZrO₂ pre-treatments was investigated by means of SEM-EDXS. Electrochemical behaviour of ZrO₂ coatings was characterized by means of potentiodynamic polarization, and electrochemical impedance spectroscopy (EIS). In addition, substrates pre-treated with sol-gel films were painted with an organic primer and top coat in order to evaluate paint adhesion and electrochemical behaviour of painted systems.