Abstract

This work is an attempt to introduce new materials as reproducible industrial materials and overtake some production obstacles by exploring the direction of chemical structure relation.

In this thesis, compacted samples have been prepared from elemental powders (Chromium, Vanadium, Aluminum and black carbon) with molar ratio (for Cr:Al:C,2:1:1 and for V:Al:C,2:1:1) by using the powder metallurgy techniques to produce Cr_2AlC and V_2AlC, the load pressure used was 30 ton for ten minutes. and the sintering temperatures (1250)°C for Cr_2AlC, (1350)°C for V_2AlC. Phase evolution is discovered by X-ray diffraction (XRD) and SEM.

Corrosion behavior of these materials was investigated and compared with SS 316L which represents the most corrosion resistant alloys in different media (0.01N HCl, 0.01N H_2SO_4, 0.01N NaCl and 0.01N NaOH) at four different temperatures over the range 30 – 60°C.

Corrosion parameters were measured by Tafel extrapolation method and the results show that the V_2AlC material has the best corrosion resistance in acidic and basic media. While in NaCl solution, Cr_2AlC material was the best. Both MAX phase materials have better corrosion resistance than SS 316L at constant conditions.

The cyclic polarization of tested materials shows no chance to pitting, which is recognized as a dangerous form of corrosion in media under study; this means that V_2AlC and Cr_2AlC materials exhibited a good resistance to corrosion.

In the optical microscopy images, little changes were noticed on the corroded surfaces of MAX materials which enhanced the low corrosion damage for these materials compared with corroded surfaces of SS 316L.