Jabbar Hussein Mohmmed Aljanaby. Effect of Glass-Ceramic Coating on Properties of The Steel Panels Used in Heat Exchanger in Power Plant. University of Technology. Mechanical Engineering Department. M.Sc. Asst. Prof. Dr. Ali Hussein Ataiwi & Asst. Prof. Dr. Ibtihal Abdel-Razzaq Mahmood. 2011. p.76.

Abstract

The present work deals with the improvement the mechanical and chemical properties of the metal parts, that work at high service temperature under severe mechanical and chemical conditions, like gas turbine blades and heat exchanger panels used in electric power generator plants, by coating with glass-ceramic.

In this work, a new glass-ceramic coating was developed and applied, as a single coat without prior chemical treatment of the surface, by using the dipping technique on metal substrate. The developed coating was designed for application on various grades of alloy steel. The selected substrates were low carbon low alloyed steel with (0.2)%C, and high carbon low alloyed steel with (0.7)%C.

Various heat treatment temperatures (500,550, and 600˚C) at different times (60 and 120 min) and with quartz addition in the range of (0-15)% were used to obtain glass-ceramics with best coating properties.

The coating properties (hardness, adherence strength, acid and alkali resistance, and thermal stability) were evaluated using suitable standard methods.

The results showed the suitability of this coating for protection the two metal substrates used in present work.

The X-ray analysis of resultant coatings showed the presence of a number of crystalline phases formed during heat treatments. The results also indicated that the coating properties were greatly improved by heat treatments in all cases, this is attributed to the formation of a complex network from crystalline phases formed during heat treatments. The same

trend was also observed with quartz addition into coating material except for alkali resistance property which decreased with quartz addition. It was found that the heat treatment at 600˚C for 120 min with 15% quartz addition brought the best values for coating properties (hardness, adherence strength, acid resistance, and thermal stability) which were improved by (70.58%, 33.84%, 86.66%, and 39.68%), respectively, while the best values for alkali resistance property were brought with free quartz added samples treated at 600˚C for 120 min.

A mathematical modeling was implemented during this work and regression equations were obtained by using (Statistical Package for Social Science (SPSS)) software to predict the experimental data for coating properties. The comparison between the predicted and measured values showed that the (SPSS) software gave a high prediction accuracy. The accuracies of prediction were (98% , 98.5% , 82.58%, 96.7% and 97.4%) for coating properties (hardness, adherence strength, acid and alkali resistance, and thermal stability), respectively.