ELECTROLESS COATING OF NON-CONDUCTING SURFACES AND PARTICLES WITH METALLIC TITANIUM IN MOLTEN SALTS

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Abstract

Based on the literature review [1-6] and results of our recent work [7], a method to coat particles of a fly ash powder (the main components of it are silica and silicates) with metallic titanium in NaCl-KCl melt has been suggested. Ti^{+2}-ions are introduced into the melt by anodic dissolution of titanium metal, and then they disproportionate in the melt according to the following reaction: $2Ti^{+2} = Ti\downarrow + Ti^{+4}$ [4]. Thin, shiny metallic coatings (presumably having two-layered structure: titanium silicide-titanium metal) have been obtained. The following mechanism of titanium silicides formation has been suggested: $4TiCl_2 + SiO_2 \rightarrow TiO_2 + 2TiCl_4\uparrow + TiSi$ (instead of TiSi different Ti-Si intermetallic compounds can be considered, all providing similar results). Mass and electron balances of the titanium metal dissolution reaction have been considered.

Acknoledgement

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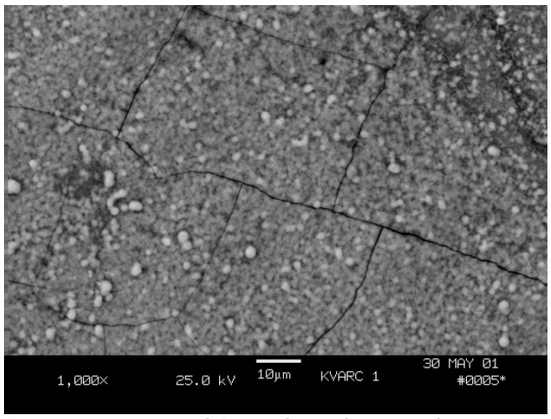

Fig. 1. SEM image of the surface of quartz after titanium deposition

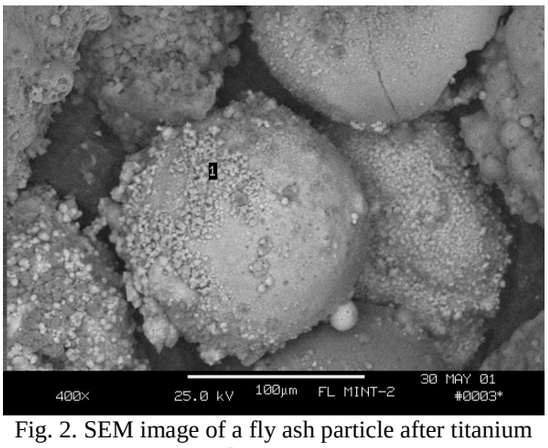

Fig. 2. SEM image of a fly ash particle after titanium deposition

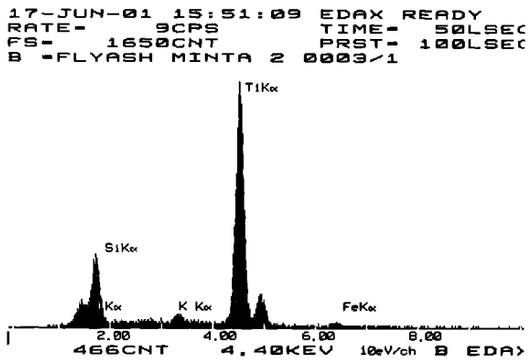

Fig. 3. EDAX spectrum of the fly ash particle (Fig. 2, point 1)

Table 1. Phases identified by X-ray analysis in the fly ash sample

Mineral name	Chemical formula	R*
Mullite	$3Al_2O_3 \bullet 2SiO_2$	1.038
Quartz	SiO_2	1.079
Titanium Silicide	**Ti_5Si_3**	1.088
Sillimanite	Al_2SiO_5	1.097
Hematyte	Fe_2O_3	1.144
Silicon Titanium	**$TiSi_2$**	1.151
Titanium Oxide	Ti_2O_3	1.247
Aluminum Oxide	Al_2O_3	1.258

* Parameter R shows how perfect is the match between the measured peaks and the reference peaks for the given material. R = 1.000 corresponds to the perfect match