The Plasma Electrolytic Modification of Metals and Alloys

The Plasma Electrolytic Modification of Metals and Alloys

By

Pavel Belkin, Sergei Kusmanov,
Sergey Shadrin and Ilya Dyakov

Cambridge
Scholars
Publishing

The Plasma Electrolytic Modification of Metals and Alloys

By Pavel Belkin, Sergei Kusmanov, Sergey Shadrin and Ilya Dyakov

This book first published 2023

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-5275-2991-6
ISBN (13): 978-1-5275-2991-5

CONTENTS

LIST OF ILLUSTRATIONS

Fig. 4-2. Hardness profile along hardened sample-anode (∅ 10 ×50 mm, steel with 0.45 % C). *1*, *2*, *3* – combination of vertical and radial jets; *4*, *5*, *6* – only vertical jets. Electrolyte flow rate is 2.0 L/min (*1, 4*), 1.5 L/min (*2, 5*), and 1.0 L/min (*3, 6*) [Belkin and Kusmanov 2016, 531-546].

Fig. 4-3. Effect of speed of electrolyte (10 % ammonium nitrate) jet on anode temperature at 250 V. Jet length is 2.5 mm (*1*), 5.0 mm (*2*), 10 mm (*3*), 12.5 mm (*4*), and 15 mm (*5*) [Belkin, Belikhov, and Sokolov 2000, 8-11]. Cylindrical samples-anodes (∅ 10 × 15 mm, steel with 0.45 % C) are used.

Fig. 4-4. Microhardness profile from surface to interior of cathode hardened steel with 0.3 %C treated during 8 s. DC voltage is 85 V, current density is 2 A/cm^2. AC voltage is 85 V, current density is 1 A/cm^2, frequency is 350 kHz [Ioshinory 1977, 116-117]. Cylindrical samples (∅ 10 × 20 mm) are used.

Fig. 4-5. Dependence of weight loss of low-carbon steel with 0.3 wt.% C (*1*) and medium carbon steel with 0.45 wt.% C (*2–4*) on friction time. *1* – sample with carburized layer (0.75–0.8 mm) and hardness of 40–50 HRC; *2* – hardened sample followed by tempering and hardness of 48–50 HRC; *3* – sample after the surface hardening by heating followed by quenching in oil with layer of 2–2.2 mm and hardness of 48–50 HRC; *4* – sample heated in the solution of potassium carbonate (25 wt.%) during 10 s (current of 150 A) followed by quenching in oil with hardness of 50–53 HRC [Ivanov, Dyachenko, and Alekseeva 1966, 72-73].

Fig. 4-6. Schemes for measurements of structure-sensitive values for non-destructive testing of PEH. *1* – bath; *2* – workpiece; *3* – standard; *4* – AC power supply; *5* – ammeter, *6* – measuring the phase shift; *7* – AC compensator; *8* – AC bridge; *9* – circuit for comparison; *10* – indicator [Mirsalimov 1971].

Fig. 4-7. Dependence of voltage U and workpiece temperature T on processing time for three-stage heating.

Fig. 4-8. Dependence of axial temperature of sample-anode (∅ 10 × 50 mm, steel with 0.5 % C) on vertical coordinate. Voltage is 200 V. One jet (*1*) and four jets (*2–5*). Distance from jets axes to chamber axis is 10 mm (*2*), 13 mm (*3*), 16 mm (*4*), and 19 mm (*5*). Solution of 10 % ammonium chloride was used [Suminov, Belkin, Apelfeld, Lyudin et al. 2011, 351].

Fig. 4-9. Hardness distribution on surface of steel sample-anode (10 × 10 × 60 mm, steel with 0.45 % C) hardened in solution of ammonium chloride (10 %). Voltage is 260 V. *1* –concentrated longitudinal flow with electrolyte flow rate 6.5 L/min; *2* –distributed longitudinal flow (6.1 L/min) where distance of longitudinal jet from chamber axes is 19 mm [Belkin and Kusmanov 2016, 531-546].