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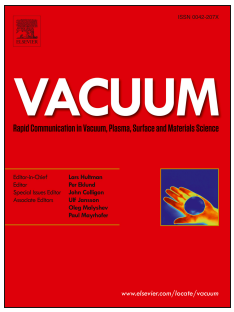

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Jianping Xu, Xiubo Tian, Chunzhi Gong, Chunwei Li, Chuang Yang

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Hollow cathode vacuum arc plasma electron source for the generation of a high-current DC electron beam

Jianping Xu[1,2,a)], Xiubo Tian[2, b)], Chunzhi Gong[2], Chunwei Li[3], Chuang Yang[1]

[1] Department of Materials and Chemical Engineering, Heilongjiang Institute of Technology, Harbin 150050, China.

[2] State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin 150001, China.

[3] College of Engineering and Technology, Northeast Forestry University, Harbin 150040, China

[a)] Corresponding author. Electronic mail: clxjp@126.com

[b)] Corresponding author. Electronic mail: xiubotian@163.com

Abstract:

This article presents the principle of operation, design, and performance data of a hollow cathode vacuum arc plasma electron source. The required electric strength of the accelerating gap can be ensured by generating a longitudinal magnetic field in the electron extraction region. This method is used to generate a high current DC electron beam. The effect of the magnetic field on the discharge and the emission characteristics of the plasma electron source are observed. With extraction voltages up to 700 V, and a magnetic field as high as 100 mT, we demonstrate a DC emission current of roughly 9 A. The hollow cathode vacuum arc plasma electron source exhibits emission characteristics characterized by three different stages: a rapid increase stage in which high-energy electrons are extracted; a slow increase stage in which a small number of high-energy electrons and a large amount of low-energy electrons are extracted together; and a stable stage.

Key words: Vacuum arc; Hollow cathode; Electron emission; Plasma electron source; High energy electron

I. INTRODUCTION

High-current electron beams have been used widely in fields such as vacuum coating, welding, and high-power microwaves [1-5]. However, with conventional thermionic cathode electron guns and field