

## 论文

### 太阳能级P型硅放电切割电流特性

南京航空航天大学江苏省精密与微细制造技术重点实验室,江苏南京210016; 南京航空航天大学机电学院,江苏南京21001

摘要:

为了提高太阳能级硅材料放电切割的效率,基于理论建模的方法,将硅材料放电切割过程抽象为简单的二极管-电阻电路模型,在恒压源的作用下分析其放电电流特性.理论推导发现,影响回路电流的主要因素是放电端二极管及体电阻的作用,随着放电温度的升高,二极管雪崩电压增大,阻碍了电流流过,热传导作用体电阻减小,促进电流流过,综合作用后,放电电流呈现出两边高中间平缓的U型曲线.在电火花线切割机床上加工电阻率 $2.1\Omega\cdot\text{cm}$ 的P型太阳能级硅,抓取放电单脉冲电流波形,结果显示:放电电流从开始的4 A下降到3.2 A,到放电结束时,上升到5.2 A.实验结果与理论推导的放电电流特性一致.

关键词: 太阳能级硅 电火花线切割 放电电流 雪崩电压 体电阻

### Current Properties of Wire Electrical Discharge Machining of P-Type Solar Silicon

Jiangsu Key Laboratory of Precision and Micro-Manufacturing Technology, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China; College of Mechanical and Electrical Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China

Abstract:

In order to improve the efficiency of wire electrical discharge machining (WEDM) of solar silicon, a diode-resistance (DR) circuit model for P-type solar silicon WEDM was created to analyze the current properties under constant voltage power supply. Theoretical analysis reveals that the circuit current is determined mainly by the diode at the discharge end and the body resistance of silicon. With the discharge continuing, the current is blocked by the increase of avalanche voltage of the diode due to high temperature, but is boosted by the decrease of body resistance due to heat transfer. As a result, a U-type discharge current curve is generated; i.e., the discharge current is high on the both sides and flat in the middle. To verify the theoretical analysis, a P-type solar silicon with resistivity of  $2.1\Omega\cdot\text{cm}$  was machined by WEDM in experiments, and a single pulse discharge current waveform was picked up. The experimental results show that the discharge current started from 4 A, then dropped to 3.2 A, and rose to 5.2 A at the end of discharge, which confirms the discharge current characteristics of the solar silicon deduced by theoretical analysis.

Keywords: solar silicon wire electrical discharge machining discharge current avalanche voltage body resistance

收稿日期 2008-11-08 修回日期 网络版发布日期 2010-02-26

DOI: 10. 3969/j.issn. 0258-2724. 2

基金项目:

国家自然科学基金资助项目(50975142);江苏省科学技术支撑计划资助项目(BE2009161);江苏省高技术研究计划项目(BG2007004)

通讯作者:

作者简介:

参考文献:

#### 扩展功能

#### 本文信息

- Supporting info
- PDF(918KB)
- [HTML全文]
- 参考文献

#### 服务与反馈

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- 引用本文
- Email Alert
- 文章反馈
- 浏览反馈信息

#### 本文关键词相关文章

- 太阳能级硅
- 电火花线切割
- 放电电流
- 雪崩电压
- 体电阻

#### 本文作者相关文章

- 邱明波
- 刘志东
- 汪 炜
- 田宗军
- 黄因慧

#### PubMed

- Article by Q. M. B.
- Article by Liu, Z. D.
- Article by Hong, W.
- Article by Tian, Z. J.
- Article by Huang, Y. H.

本刊中的类似文章

1. 邱明波; 刘志东; 汪 炜; 田宗军; 黄因慧. 太阳能级P型硅放电切割电流特性[J]. 西南交通大学学报, 0,(): 23-27

文章评论 (请注意: 本站实行文责自负, 请不要发表与学术无关的内容! 评论内容不代表本站观点.)

反 馈 人	<input type="text"/>	邮箱地址	<input type="text"/>
反 馈 标 题	<input type="text"/>	验证码	<input type="text" value="1359"/>