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### GH4169合金直接时效锻造过程的数值模拟

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### NUMERICAL SIMULATION OF DIRECT AGED FORGING PROCESS OF GH4169 ALLOY

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摘要

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**摘要** 直接时效(DA)锻造工艺已成为生产GH4169合金涡轮盘锻件的基本方法之一。但实施DA锻造工艺时,锻造过程的各个环节要求严格控制,而且要有足够吨位的设备。参照在压力机上实施DA工艺的终锻过程,用有限元变形-传热耦合分析方法对直径520mm和高度190mm的GH4169合金坯料在不同情况下的镦粗过程进行了数值模拟。大量计算结果表明,在压力机上实施DA锻造工艺时,为了获得优质GH4169合金涡轮盘锻件,应合理确定压力机滑块速度,尽可能改善润滑情况及适当提高模具预热温度。对于GH4169合金涡轮盘锻件,采用等温DA锻造工艺可能是最佳的选择。研究结果对于在国内的生产条件下实施GH4169合金DA锻造工艺具有指导作用

**关键词:** GH4169合金 直接时效工艺 锻造 数值模拟

**Abstract:** The direct aged (DA) processing has become the basic processing technology to produce GH4169 alloy disk forgings for high performance aeroengines. During the DA processing, however, it is necessary to strictly control every step of forging process and employ the forging equipment with enough capacity. Referring to the finish forging process of DA processing in forging press, the upsetting processes of GH4169 billet with 520mm diameter and 190mm height under several conditions were simulated by coupled thermomechanical finite element method. The results of numerical simulation indicate that in order to obtain high quality GH4169 alloy disk forgings, it is necessary to determine the ram velocity reasonably, improve the lubrication condition and raise the dies temperature appropriately. For the GH4169 alloy disk forgings, the isothermal DA forging process may be the best choice. The results of this study may provide a guide for DA processing of GH4169 alloy disk forgings at home.

**Keywords:** GH4169 alloy direct-aged processing forging numerical simulation

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