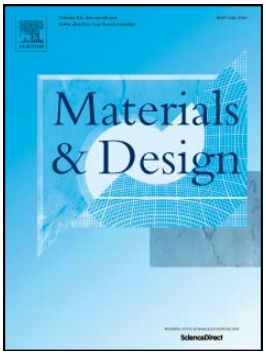

The effect of thermal cycling in superplastic diffusion bonding of 2205 duplex stainless steel

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The effect of thermal cycling in superplastic diffusion bonding of 2205 duplex stainless steel

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Abstract: In view of the requirement of large cold rolling deformation and bonding pressure in the conventional superplastic diffusion bonding of 2205 duplex stainless steel, a novel method of introducing thermal cycling into the process was proposed. During the thermal cycling process, due to the change of temperature, surface chemical activity of 2205 duplex stainless steel was improved, activity of atoms and grain boundaries were improved, and the recrystallized grains were refined. The shear bond strength of joint prepared in the mode of thermal cycling using specimens with the cold roll reduction of 60% was 15MPa higher than that of conventional bonding using specimens with the cold roll reduction of 85%. Compared to the shear bond strength of 430MPa under the specific pressure of 10MPa after conventional bonding, shear bond strength of 623MPa was obtained under the condition of T_{max}=1000℃, T_{min}=900℃, cycle number of heating and cooling N=3, specific pressure P=5MPa.

Key words: Superplastic diffusion bonding; thermal cycling; duplex stainless steel; microstructure.

1 Introduction

The duplex stainless steel usually has two phases of ferrite and austenite, thus, it has excellent corrosion resistance and high strength combined high toughness. And it is commonly known for its excellent performance [1-2]. In addition, the duplex stainless steel also has better superplasticity, and the elongation of more than 1500% could be obtained under certain circumstance [3]. The NAS Murdork Company in Japan has successfully fabricated aircraft lavatory basin using 2507 duplex stainless steel which has been applied in boeing passenger [4]. The superplastic diffusion bonding technology is a method of achieving bonding of two materials by atomic diffusion in the solid state. Components with hollow sandwich structure could be manufactured through this way [5]. Weight of component could be lightened; also the integrity and load efficiency could be improved. The current research of superplastic behavior and diffusion bonding technology mostly concentrates on titanium alloy [6-7], aluminum alloy [8-10] and magnesium alloy [11-12] etc.

For the past few years, with rapid development of aviation and marine industry, the superplastic diffusion bonding components have been applied wildly [13-15]. Especially the structural materials used in vessels and bridges has greater demands on the chloride stress corrosion resistance, which made the duplex stainless steel components attract more attention [16-18]. Thus, the superplastic diffusion bonding technology of duplex stainless steel has broad application prospect in coastal city construction and marine weapon equipment fields [19-21]. However, as to duplex