Material Technology

R&D Endorsement

Title

Structure, Method, And Application For High Speed Strenthening Of Metal

Abstract	The method of instantaneous electrical current-assisted processing is used to protect Al-based alloy from fracture during high-speed impact, thereby improving the safety factor. We designed an in situ split Hopkinson pressure bar experiment under electric current to mimic the high-speed impact scenario of a car accident. Experimental results show that the aluminum alloy can withstand severe compression deformation without fracture after electrified impact. In contrast, the aluminum alloy after pure impact without electric current is severely shattered, indicating that electric current can effectively strengthen the structure of the alloys. The damage mechanism of current- assisted high- speed impact on aluminum alloys has been verified by a series of material analysis methods, including transmission electron microscope technology, backscattered electron diffraction technology, etc.
Benefits	Traditional metallurgy often uses heat treatment and other technologies to strengthen the strength of the alloy and enhance the mechanical properties of the metal. However, some alloys would face the softening issue during processing such as baking. For instance, the mechanical strength of Al-based alloys would significantly decrease during baking, which is detrimental to its application. The current method is used to solve the damage problem of the structural column of the car body when it is hit at high speed. This method can maintain the original strength of the aluminum alloy after T6. Without changing the original composition and heat treatment procedure, the electric current is used to assist the AB pillars of the car body in not fracturing during the collision process of the car body, which can greatly improve driving safety. Through this technology, the metal can be effectively strengthened instantly with current in a short period of time. In addition to being used in the structural materials of traditional automobiles and electric vehicles, it can reduce the casualties of personnel in high-speed impacts, and it is expected to be applied to the structures of various important industrial systems in the future.
Industry Categories	Metal processing industry, metal manufacturing industry, automobile and motorcycle manufacturing industry, ship manufacturing industry, aviation manufacturing industry, military industry
Keywords	current-assisted secondary processing Electrically- Assisted Manufacturing (EAM), Electro plasticity
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