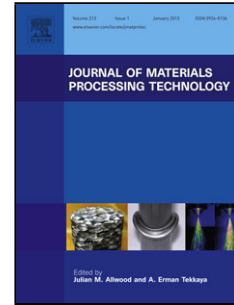


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# Electromagnetic Cold-expansion Process for Circular Holes in Aluminum Alloy Sheets

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## ABSTRACT:

Although the mechanical cold-expansion process may improve the fatigue life of holes in workpieces to some extent, various inherent limitations of this process restrict further improvement of the fatigue life of holes. To overcome the limitations of the mechanical cold-expansion process, a new electromagnetic cold expansion process with a dual-stage coil system, which expands holes by a radial pulsed electromagnetic force, is presented in this paper. The basic principle and implementation of the process are analyzed in detail. Then a series of experiments for cold expansion of holes in sheets made of 2A12-T4 aluminum alloy, is carried out to validate the proposed method. Results show that it can significantly improve fatigue life and increase the fatigue limit of specimens from 60 MPa to about 127 MPa. Compared with the mechanical cold expansion processes, the fatigue life has doubled in high maximum nominal stress, which is mainly attributed to non-contact processing and more uniform residual stress distribution. Moreover, it can be concluded that the new process can strengthen different types of holes (i.e. special-shaped, small) that are difficult to be processed by conventional cold expansion processes.

*Keywords:* Cold-expansion; Electromagnetic strengthening; Pulsed electromagnetic force; Fatigue; Circular holes

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