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Crystallographic Texture Evolution of Aluminum Alloy 3104 in the Drawn and Wall Ironing (DWI) Process

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The relevance of crystallographic texture in the formability of rolled metals has been widely researched and some manufacturing processes go to great lengths to assure the adequate texture is present in their final products. The aluminum beverage can and end industry and their metal suppliers, given the nature of the production processes used, are very much aware of the importance of having material with very specific crystallographic textures. The well-known earing effect, its location in relation to the rolling direction and its intensity, unavoidable because of anisotropy in aluminum alloys, can affect in significant ways the performance of the drawn and wall ironed (DWI) can body manufacturing processes. The present paper seeks to add information about the crystallographic texture of the aluminum alloy 3104 H-19 during the different steps it undergoes from a flat sheet of metal to a cylindrical body. The degree of total strain during the 5 steps was 5%. The work scope encompass from the cup drawing to the final ironing operation and its main objective is to add information on the texture evolution the aluminum alloy undergoes in the intermediary steps. To this aim pole figures and orientation distribution functions were generated and analyzed in the different steps. Crystallographic texture continues to change from the drawn cup through the ironing stages. For samples gotten from the rolling direction (0o) there is a slight sharpening of the texture originally present in the drawing stage up until the 5th stage. Samples removed at 45o and 90o in relation to the rolling direction display a pole figure rotation in the direction of the metal flow. This rotation is assumed to be an alignment of the grain with the plastic flow of the material. If ironing would continue indefinitely, a new reference direction would be clearly defined for the wall of the cylindrical body. The ODFs show that different deformation textures may not behave similarly during continued plastic deformation. The copper {112} <111> deformation texture increases in intensity after the final ironing stage in relation to the texture intensity found in the coil. The brass {110} <112> deformation texture decreases in intensity after the final ironing stage in relation to the texture intensity found in the coil. The cube {001} <100> recrystallization texture decreases steadily from the original coil intensity thought the five intermediate steps until the final ironing.