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Fabrication of Functionally Gradient Porous Aluminum Using NaCl as Space Holder

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Summary

Functionally graded (FG) aluminum (Al) foam, which consists of multilayers of different Al foams, is expected to exhibit higher functionality than ordinary uniform Al foam. In this study, uniform Al foams and a two-layered FG Al foam with different types of Al were fabricated by a friction powder sintering process and a sintering and dissolution process. From X-ray computed tomography (CT) inspection of the obtained foams, it was confirmed that NaCl was completely removed from the foams by dissolution. In addition, the FG Al foams in each layer had almost constant porosity (NaCl volume fraction, V_f) with seamless bonding between the layers. From the static compression tests of uniform foams, it was shown that the compression properties can be controlled by varying the type of Al, which is a similar tendency to the mechanical properties of the bulk materials. In addition, the compression properties can be controlled by varying V_f, regardless of the type of Al. From the static compression tests of FG Al foams, the foams exhibited multiple compression properties corresponding to the deformation of each layer for various V_f and different types of Al, which were similar to those of the corresponding uniform foams. The advantage of varying the type of Al is that the mechanical properties of foams can be controlled without changing their geometric structures. Therefore, FG Al foams with various V_f and types of Al are expected to enable the optimum design of foams used for structural materials.