CAULKING OF DISSIMILAR MATERIALS USING SHOT PEENING

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ABSTRACT
In this work, caulking of a dissimilar material using shot peening was investigated. The availability of the plastic flow, i.e., the peening droop makes the joining of the dissimilar material possible. This method is similar to caulking. In the experiment, two kinds of shot peening machines, air type and centrifugal type, were employed. In order to examine experimentally the influence of working temperature on bondability, equipment with a heating furnace was produced. The influence of processing conditions on the joining of the dissimilar material and the substrate was examined. The bond strength was evaluated by tensile test. The dissimilar materials were successfully joined to the substrate by the peening droop. The bond strength increased with kinetic energy of shots and processing temperature. It was found that the present method using the peening droop was very effective for joining dissimilar materials.

INTRODUCTION
Shot peening has been used widely in order to improve the performance of engineering components [1]. In this process, the material surface is hit repeatedly with a large number of cast steel shot. This action causes a large plastic deformation of surfaces. However, when the processing becomes excessive, plastic flow characterized by a shear droop occurs at the edge of the substrate. If the dissimilar material is put in the hole on the surface and then shot-peened, it can be joined to the substrate.

In the present study, caulking of dissimilar materials using shot peening was investigated. The influences of air pressure, projection density and processing temperature on bondability were examined. The bond strength was also evaluated by the tension test.

EXPERIMENTAL DETAILS
Shot peening treatment was performed by using air type and centrifugal type peening machine. In the case of air type machine, air pressure was in the range of 0.4-0.8 MPa and projection density was in the range of 900-8100 kg/m². The shot used was made of high carbon steel with an average diameter of 1.0 mm. The experiment was performed between room temperature and 400 °C in air. The substrates were metal and the dissimilar materials were metal, ceramics and plastic. The bond strength between the dissimilar material and the substrate was evaluated by tension test. In fact, the strength was evaluated in the force which pulled out the dissimilar material from the substrate.

RESULT AND DISCUSSION
The appearances of the workpieces after shot peening are given in figure 1. Air pressure and projection density are 0.8 MPa and 2700 kg/m². The processing temperature is room temperature. The dissimilar materials are successfully bonded to the substrate by the peening droop. On the other hand, the bond strength increases as working temperature increases. The amount of plastic flow near the surface increases with working temperature.

CONCLUSION
The dissimilar materials can be joined to the substrate due to the peening droop generated by the large plastic deformation during shot peening. The present method using the peening droop was effective for joining the dissimilar materials.

Reference