Supplementary Materials

During ultrasonic assisted sintering (UAS), temperature is in-situ measured using thermocouple embedded in the bottom of the aluminum particles, the measured temperature-time curves are shown in Figure S1. It can be found that with the increase of cylinder pressure, the temperature rises more greatly. The maximum temperature reaches up to ~610 °C, which is close to the melting point of pure aluminum.

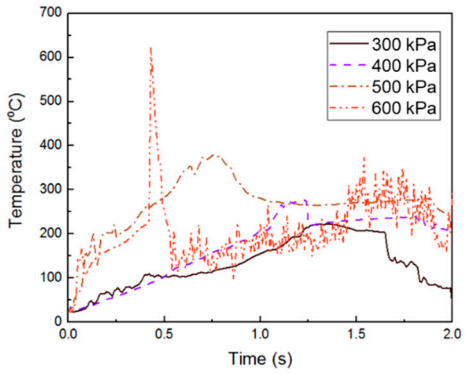

Figure S1. Temperature rise during ultrasonic assisted sintering process.

These relatively high temperatures can also be verified from the strips squeezed out from the gap between punch and mold during sintering of the particles, as shown in Figure S2. The gap between punch and mold allows the vibrational movement of the punch at ultrasonic frequency, inevitably some fine particles escape through the gap in the initial stage of sintering. However, in the later stage, under the action of ultrasonic vibrational punching, narrow strips can be observed squeezed out from the gap, which make it clear that the particles are fused together at relative high temperature during UAS process caused by mechanical movement.

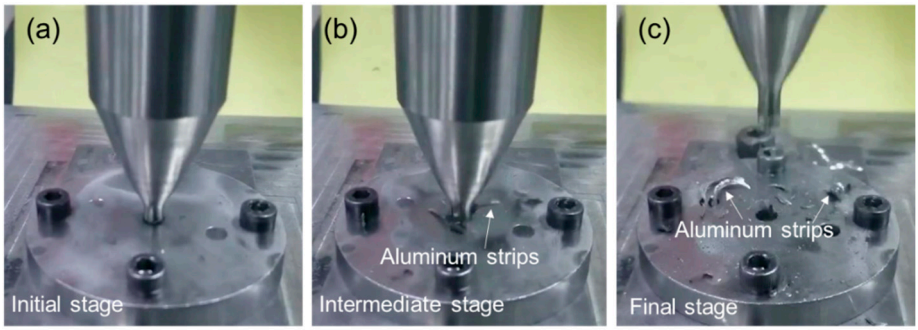

Figure S2. The snapshots showing aluminum strips squeezed out from the gap between punch and mold during ultrasonic assisted sintering.