Supporting Information:

Fiber Implantation for Interfacial Joining of Polymer to Metal

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S1. Condition of Laser-induced powder jet implantation process.

Laser mode	-	Pulse
Wavelength	nm	1064
Laser peak power (oscillator)	J	45 (on average)
Laser peak power (output)	J	20 (on average)
Pulse duration	ms	10
Distance from nozzle to metal	mm	100
Incidence angle*	°	90

*Defined as the angle between in-plane direction of metal substrates and long axis of jet nozzle

S2. Injection molding process for joining metal polymer to metal. Commercial injection molding machine Roboshot α-100iA (Fanuc Co.) was used for joining the treated aluminum substrate with an in-house polyester polymer (DuPont Co.). The polymer pellet was dried under vacuum oven at 120°C for 3 hours prior to injection molding. The treated substrate was set in the cavity (Cavity size: 45 × 18 × 1.5 mm) of a mold heated at 140°C. After closing and clamping the mold with 3 sec delay, the melting polymer was injected on the top of treated substrate (contact area: 50 mm^2). The ejected assembly was cooled at room temperature, and then thermally annealed in vacuum oven at 150°C for 1 hour.

S3. Evaluation of metal surface and shear strength. The surface of treated aluminum substrate was observed by a scanning electron microscope Miniscope TM-1000 (Hitachi Science Systems, Co., Ltd.) before and after joining the polymer. All observations were conducted under the pressure up to 15 Pa at the accelerated voltage of 15 kV. The interfacial shear strength of the metal/resin joined test pieces was evaluated by an universal testing machine AutoGraph

AG20kNX plus (Shimadzu Co.) equipped with a load cell of 20 kN and an in-house jig for shear strength. The stress-strain curve was recorded under tensile mode at the speed of 10 mm/min. All evaluations were conducted under 23°C and 50%RH.

S4. Image analysis for SEM observation. The SEM images of fiber implanted substrates were converted to binary images using ImageJ software (National Institutes of Health, NIH). The percentages of polymer region (white area) were calculated as polymer coverage on the surface of aluminum substrates. This image analyses were conducted for a part of SEM images in Figure 4(b) and (c).

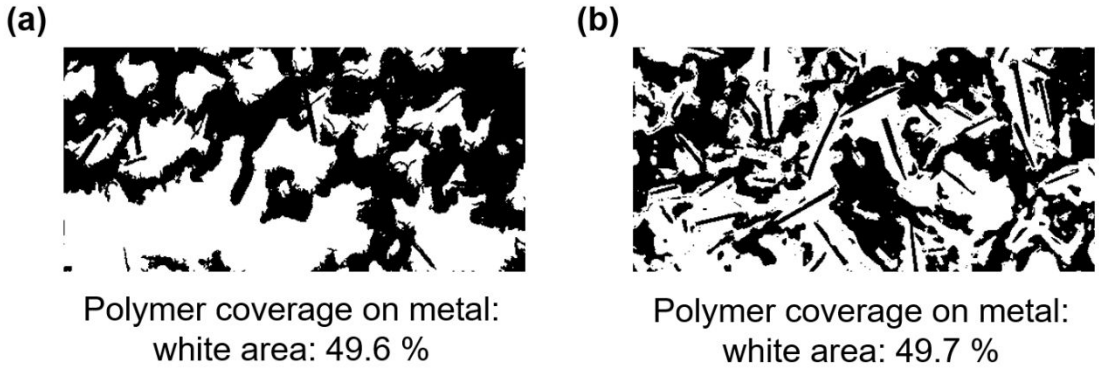

Figure S1. Binary images of (a) fiber implanted substrate (fiber length: 40 μm) and (b) fiber implanted substrate (fiber length: 80 μm).