

Supporting Information

Toughness and Durability of Interfaces in Dissimilar Adhesive Joints of Aluminum and Carbon-Fiber Reinforced Thermoplastic

Lingyun Lyu^{a,c}, Yoshino Ohnuma^a, Yuri Shigemoto^{a,c}, Takeshi Hanada^a, Tamaki Fukada^{a,c},

Haruhisa Akiyama^a, Nao Terasaki^{a,b}, Shin Horiuchi^{a,}*

^a Research Laboratory for Adhesion and Interfacial Phenomena (AIRL), Nanomaterials research Institute, National Institute of Advance Industrial Science and Technology (AIST), 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565 Japan

^bSensing System Research Center (SSRC), National Institute of Advanced Industrial Science and Technology (AIST), 807-1 Shuku-machi, Tosu, Saga 841-0052, Japan

^c Innovative Structural Materials Association (ISMA), 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565 Japan

*Corresponding Author E-mail: s.horiuchi@aist.go.jp.

Supporting Information Content

7 pages (including the cover page)

5 Figures and 3 movies

Figure. S1 SEM back-scattered images of the cross sections of the cured (a) epoxy and (b) urethan adhesives. The EDX elemental maps of the inorganic fillers are shown below the corresponding SEM images. (c) is the Ca K elemental map of the region indicated in (a), and (d) and (e) are Ca and Mg K maps of the entire region of (b).

Figure. S2 Al/CFRTP thickness ratio dependence on the plastic deformation of the Al beams after the DCB test of the Al/CFRTP adhesive joints. The total thickness was fixed at 7mm and the thickness ratio was varied.

Figure. S3 STEM-HAADF images of the adhesive interfaces between PA6 and the epoxy adhesive. Upper: no treatment; middle: acetic acid treatment; lower: flame treatment.

Figure. S4. ATR-FTIR spectra of PA6 with no treatment, acetic acid treatment and flame treatment.

Figure. S5 Effect of surface treatments on dynamic contact angles of PA6.

Video S1. Video showing the process of flame treatment.

Video S2. Animation showing the 3D structure of the Al/adhesive interface created by STEM-tomography.

Video S3. Video showing the crack growth behavior in the ML-assisted ADCB test of non-treated (upper), acetic acid-treated (middle) and flame-treated (lower) specimens. The video is displayed 3-4 times faster than the test speed.

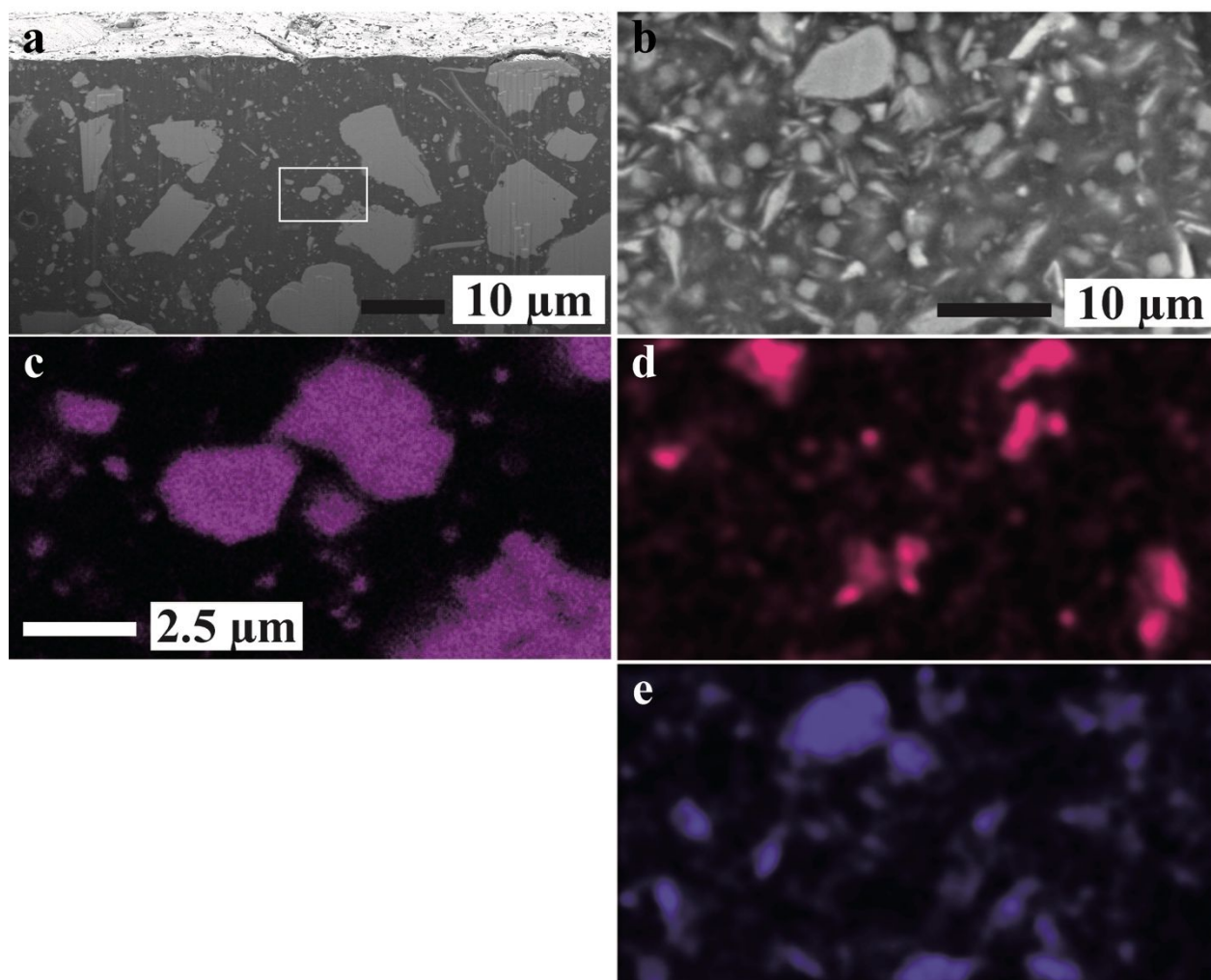


Figure. S1 SEM back-scattered images of the cross sections of the cured (a) epoxy and (b) urethane adhesives. The EDX elemental maps of the inorganic fillers are shown below the corresponding SEM images. (c) is the Ca K elemental map of the region indicated in (a), and (d) and (e) are Ca and Mg K maps of the entire region of (b).



Figure. S2 Al/CFRTP thickness ratio dependence on the plastic deformation of the Al beams after the DCB test of the Al/CFRTP adhesive joints. The total thickness was fixed at 7mm and the thickness ratio was varied.

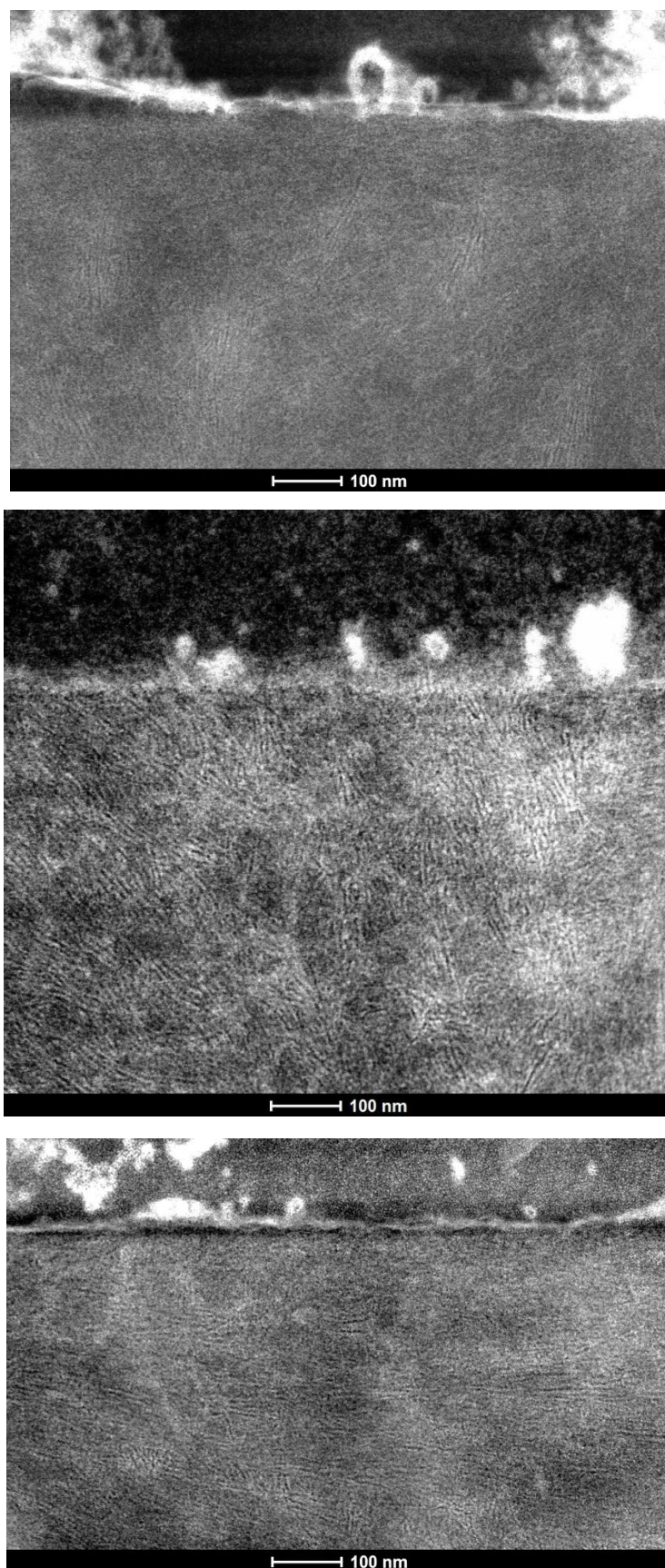


Figure. S3 STEM-HAADF images of the adhesive interfaces between PA6 and the epoxy adhesive. Upper: no treatment; middle: acetic acid treatment; lower: flame treatment.

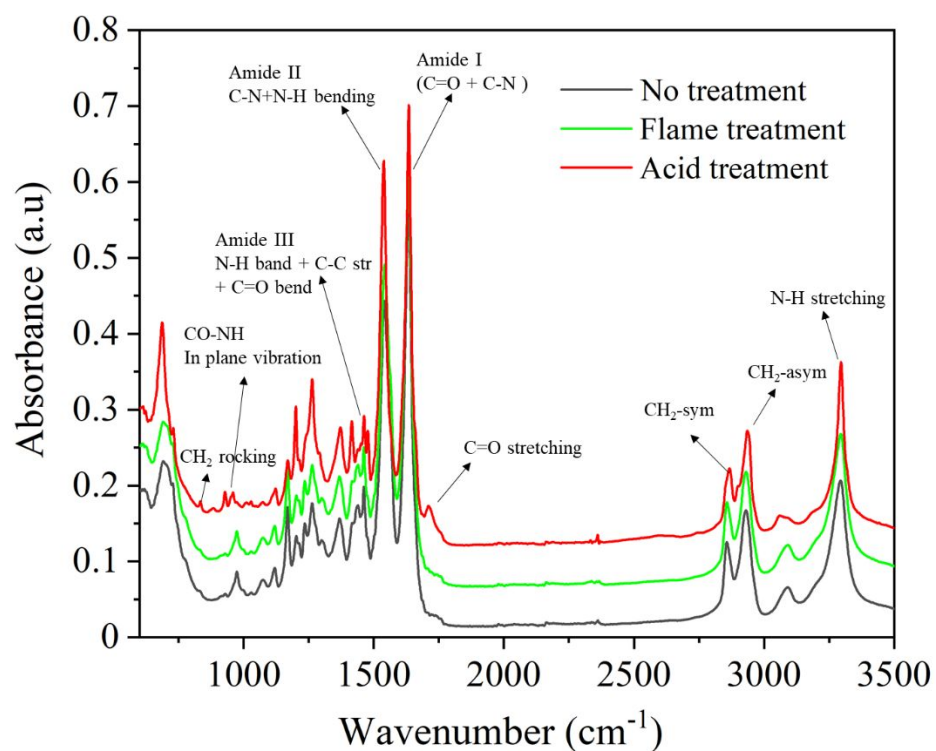


Figure. S4 ATR-FTIR spectra of PA6 with no treatment, acetic acid treatment and flame treatment.

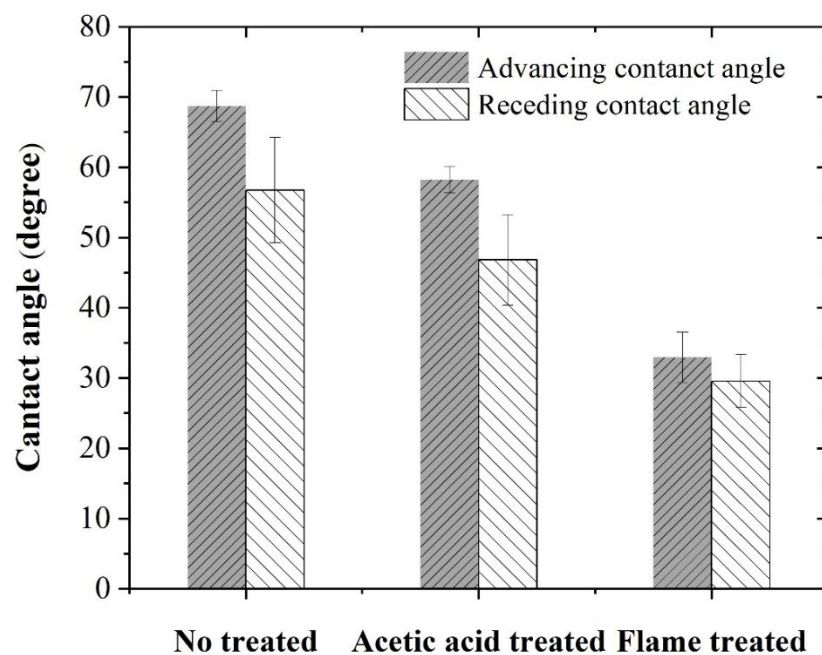


Figure. S5 Effect of surface treatments on dynamic contact angles of PA6.