Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information for

Etchant-free graphene transfer using facile intercalation of alkanethiol self-assembled molecules at graphene/metal interfaces.

Manabu Ohtomo[†], Yoshiaki Sekine[†], Shengnan Wang[†], Hiroki Hibino[†,‡,*], and Hideki Yamamoto[†]

[†] NTT basic research laboratories, Nippon Telegraph and Telephone Corporation, 3-1 Morinosato-Wakamiya, Atsugi, 243-0198, JAPAN

[‡] Department of Nanotechnology for Sustainable Energy, School of Science and Technology, Kwansei Gakuin university, 2-1 Gakuen, Sanda, Hyogo 669-1337, JAPAN

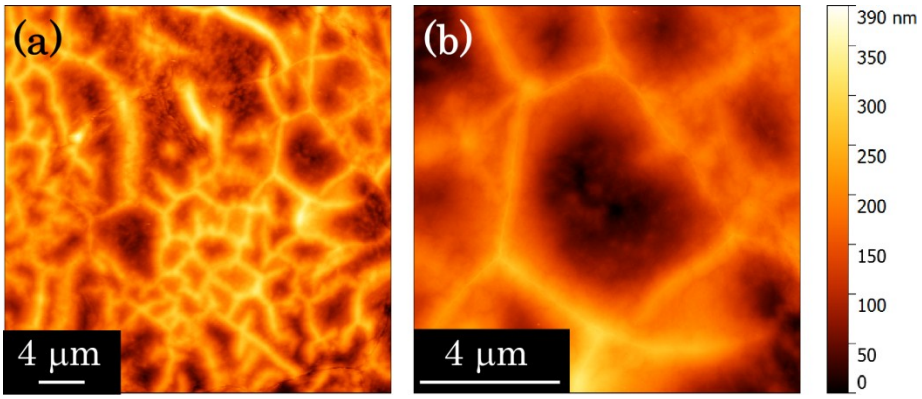

Figure S1. Topographic image of graphene/Cu foil after immersion in 1 mM ethanol solution of 7-carboxy-1-heptanethiol. The intercalated multilayers of 7-carboxy-1 -heptanethiol induce large protrusion at wrinkles of graphene.

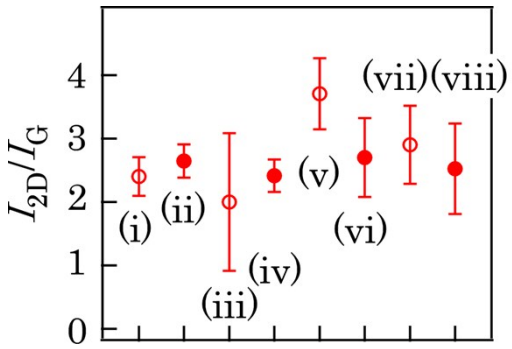

Figure S2. Ratio of Raman 2D peak and G peak intensity in (i) pristine graphene/Cu foil, (ii) graphene/Cu foil after octanethiol intercalation, (iii,iv) graphene/Cu(111) (iii) before and (iv) after intercalation, (v,vi) graphene/Cu(110) (v) before and (vi) after intercalation, and (vii,viii) graphene/Cu(100) (vii) before and (viii) after intercalation.

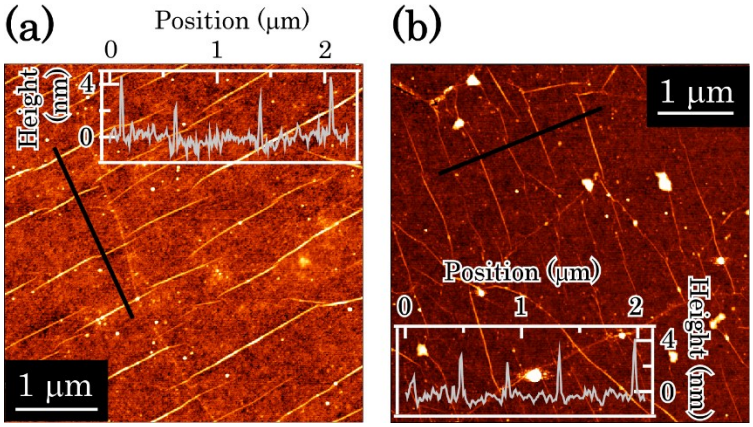

Figure S3. AFM topographic images of graphene on SiO_2 transferred from (a) Cu foil using thiol intercalation method, and (b) Cu foil using conventional $FeCl_3$ etching+HCl rinse method. Cross-sectional line profiles of black solid lines are shown in inset. The roughness average (R_a) of (a) and (b) were 0.46 nm and 0.35 nm, respectively.

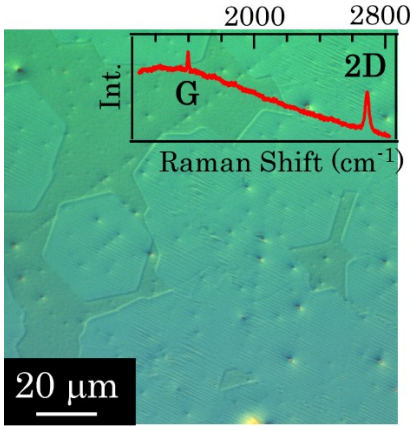

Figure S4. Optical microscope image (differential interference contrast mode) of hexagonal graphene grains grown on reused Cu(100) single crystal. Inset shows Raman spectrum of graphene on reused Cu.

Table S1. The Hall mobility and carrier density of graphene transferred by conventional etching method and thiol-intercalation method.

	Etching-method ($FeCl_3$+HCl)	**Thiol-intercalation method**
hole, 300 K	2569 cm^2/Vs at 5.2×10^{11} cm^{-2}	4887 cm^2/Vs at 4.8×10^{11} cm^{-2}
electron, 300 K	3863 cm^2/Vs at 5.0×10^{11} cm^{-2}	5900 cm^2/Vs at 5.0×10^{11} cm^{-2}
hole, 2 K	2394 cm^2/Vs at 5.5×10^{11} cm^{-2}	8097 cm^2/Vs at 4.86×10^{11} cm^{-2}
electron, 2 K	2985 cm^2/Vs at 4.84×10^{11} cm^{-2}	7289 cm^2/Vs at 4.7×10^{11} cm^{-2}