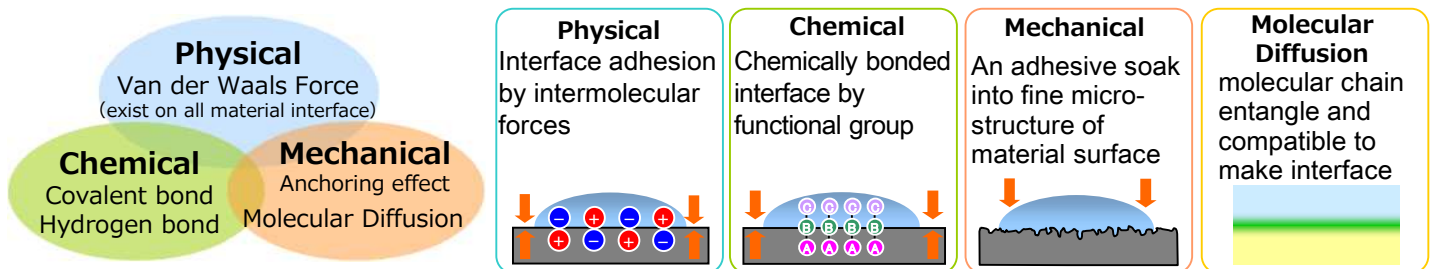


Adhesiveness of Dissimilar Materials

~ Analysis and Evaluation for Material Interface ~

In terms of ADHESION of polymer with other materials (polymer, metal), characteristics of polymer have a great impact on adhesiveness. In case polymer has reactive functional groups, structural analysis of adhesive interface is highly effective. In other case of crystalline polymer, crystallinity evaluation of interface can be found as correlational results with adhesiveness.

Major Factor and Analysis for Adhesiveness



Surface / Interface Analysis	Methods	Adhesive Factor
Components, Chemical Formula	XPS, TOF-SIMS, FT-IR	Physical, Chemical
Shape of Fine Structure Crystallinity	SEM, TEM, AFM, DSC, X-ray Diffraction, Raman	Mechanical, Physical, Molecular Diffusion
Wettability, Surface Free Energy	Contact Angle	Physical, Mechanical, Chemical

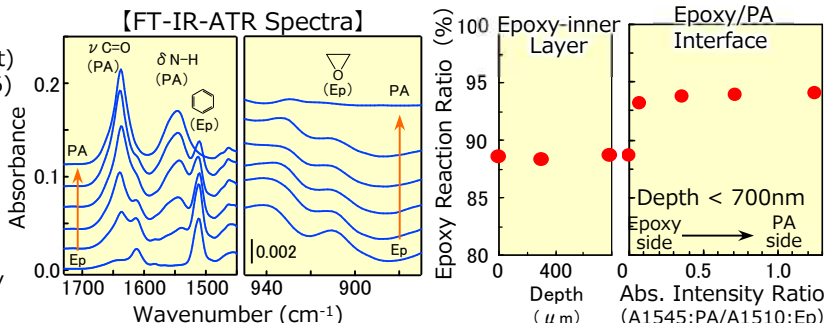
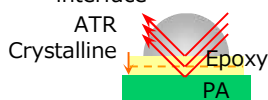
Polymer / Polymer – Status of Chemical Bond at Interface –

Specimen

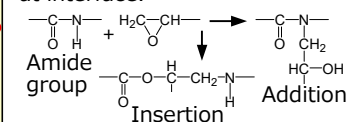
- Adhesive : Epoxy (2 component)
- Substrate : PA (Nylon6)

Preparation

- (1) Coat epoxy on PA
- (2) Heat 1h @120°C
- (3) Polish and observe interface



Reaction ratio of epoxy at interface of PA is 5% higher than that of epoxy inner layer. It is considered epoxy and PA were bonded by amide group at interface.

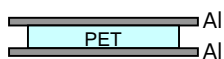


Chemical analysis of surface / interface structure is very effective for molecular design of Adhesive having reactive functional group.

Metal / Polymer – Crystallization of Interface Influence for Adhesiveness –

Specimen

- Al foil (12 micron)
- PET film (200 micron)



Preparation

- (1) Melt PET @295°C
- (2) After fused on Al foil,
 - ① Quenching
 - ② Quenching & reheating 1h @130°C
 - ③ Slow cooling

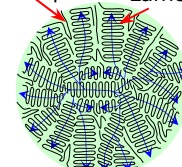
PET T_m 263°C
T_g 69°C

[Polarizing Microscope Observation (Crossed Nicol)]

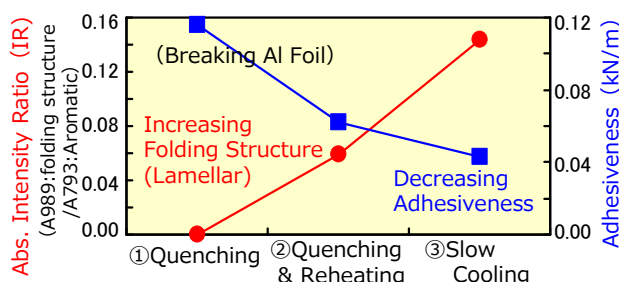


① amorphous, ② & ③ Spherulites in different size observed

[Schematic Diagram of Spherulites] Amorphous Lamellar



The larger Spherulites become, the lower the adhesiveness is. It is considered size/density of spherulites relate to mechanical properties of polymer and internal stress derived from spherulites formation have some impact on adhesiveness.



In the case of crystalline thermoplastic resin (PE, PP, PET, PPS, PEEK), crystalline growth at the temp. of quenching or operating have a great impact on adhesiveness. It is important to understand precisely thermal properties of polymer (T_m, T_g, T_c) and consider operating conditions.