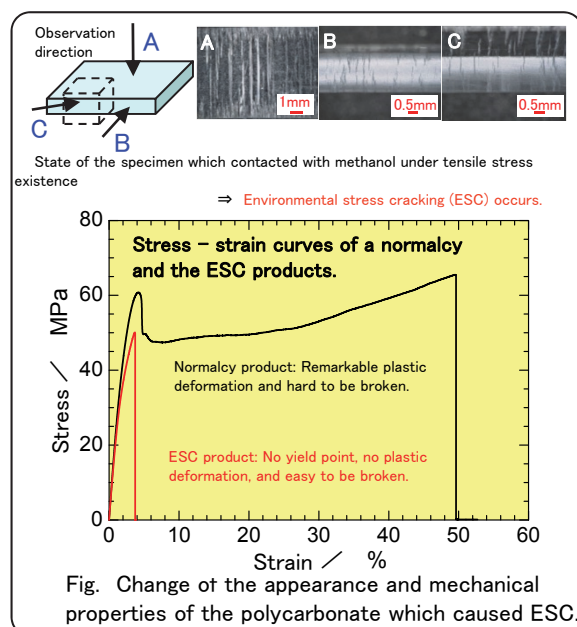


What to do, if plastics component has broken –Cause analysis approaches–

The scenes, which need cause analysis of destruction and damage at the time of the use in the plastic parts, are increasing. We introduce here an approach example of analyzing a damage cause versatility by applying the most suitable technique on the basis of the characteristics of various plastic materials.

Characteristics of Plastics

Mechanical property	•Low-stiffness viscoelastic(plastic) body. •Large Influence of the heteromorphic speed on strength and heteromorphic ability. •Conspicuous creep and stress-relaxation(in some case).
Thermostability	•Low heat resistance, and large temperature-dependent characteristic value. •Large mechanical characteristic change below and above T_g. •Easy physical and chemical structural change by heating.
Water absorbency	•Very large water absorptivity (particular in polyamide). •Large humidity dependence of the characteristic (value).
Chemical resistance	•Low resistance to organic reagent. •Environmental stress crack by chemicals(in some case).
Weatherability	•Low weatherability, and easy deterioration by UV.



Approach example to the destruction analysis of plastic parts

Generally, the comparison between an accidental or a damaged product and a normalcy or a fresh product is fundamental.

What to do	Item	Analysis method	Viewpoint(What to check)
At first, observation of situation	How stress Placed on?	Fractographic study (OM, SEM)	Stress style (Tension, Bend, Torsion, etc.) Fracture style (Brittleness or ductility, Instant or slow(fatigue), etc.) Starting point of the fracture (<u>Alien substance</u> , Void, Scratch, etc.)
	Investigation of property	Mechanical of property	Identification by XMA Broken by deterioration or no deterioration ?
		Frequently hard to measure because of small object or complicated shape.	
Next, structure analysis			
Physical	Molecular weight	GPC	The smaller molecular weight, the lower mechanical property.
	Crystallinity	DSC, XRD, Density	The higher crystallinity, the higher fragility.
	Cure extent, Degree of cross-linkage	DSC, FTIR, Raman, Solubility	The lower cure extent, the lower mechanical property. The higher degree of cross-linkage, the higher fragility.
Chemical	Chemical bonding	FTIR, Raman, NMR, Composition analysis etc.	Difference of chemical structure with the normalcy product ? Difference of quantity and the kind of the additive ?
Finally, Influence of use environment. (Durability investigation)	Dynamics environment	Fatigue, Creep test, Thermostability	Inspection and consideration of the deterioration Structure by model experiment. Life estimation.
	Atmosphere	Weatherability (Light fastness)	
		Chemical resistance	

Although some representative items are shown in the upper figure, it is important to include the other analysis technique from different angles in the real analysis. In that case, various information including the use environment is necessary, because detailed information of the fracture modes is helpful.