

# Pyrolysis of CFRP and reforming of gases by zeolite catalysts in CFRP recycling

## Part 3: Searching for optimal catalytic reaction conditions

**[Background]** In Part 1 ([PYA1-116E](#)) and Part 2 ([PYA1-117E](#)), with the optimum catalyst for the decomposition of epoxy resin, the formation of valuable products is selectively controlled in the reforming of the gases generated by the pyrolysis of CFRP. Previous studies clearly show that BEA catalysts promote the decomposition of bisphenols and suppresses the formation of naphthalene. In this note, the optimum reaction conditions for the recovery of phenol which has a higher economic value than the other reaction products are examined using the BEA catalyst (Si/Al = 92.5).

**[Experimental]** A rapid catalyst screening system in which a Tandem μ-Reactor (Rx-3050TR) interfaced directly to the GC injector was used for the measurements. Prepreg (T700SC/2592) was used as the CFRP. 0.3 mg of CFRP was placed in a sample cup and introduced into the 1<sup>st</sup> Reactor which was heated at 500 °C. The gases generated flowed directly to a quartz reaction tube (containing the catalyst) in the 2<sup>nd</sup> Reactor. The catalytic products were separated and detected by GC/MS.

**[Results]** The chromatograms of the products obtained from the catalytic reforming of the gases generated from the pyrolysis of CFRP are shown in Fig. 1. The relative contact time with the catalyst is assumed to be directly related to the height of the packed bed in the reaction tube – assuming a constant flow at each height. It is clear that the peak intensity of phenol decreases, and the amount of naphthalene, which is considered to be a secondary product, increases as a function of contact time; thus, mg quantities of the proper catalyst will suppress the formation of naphthalene and increase the yield of phenol.

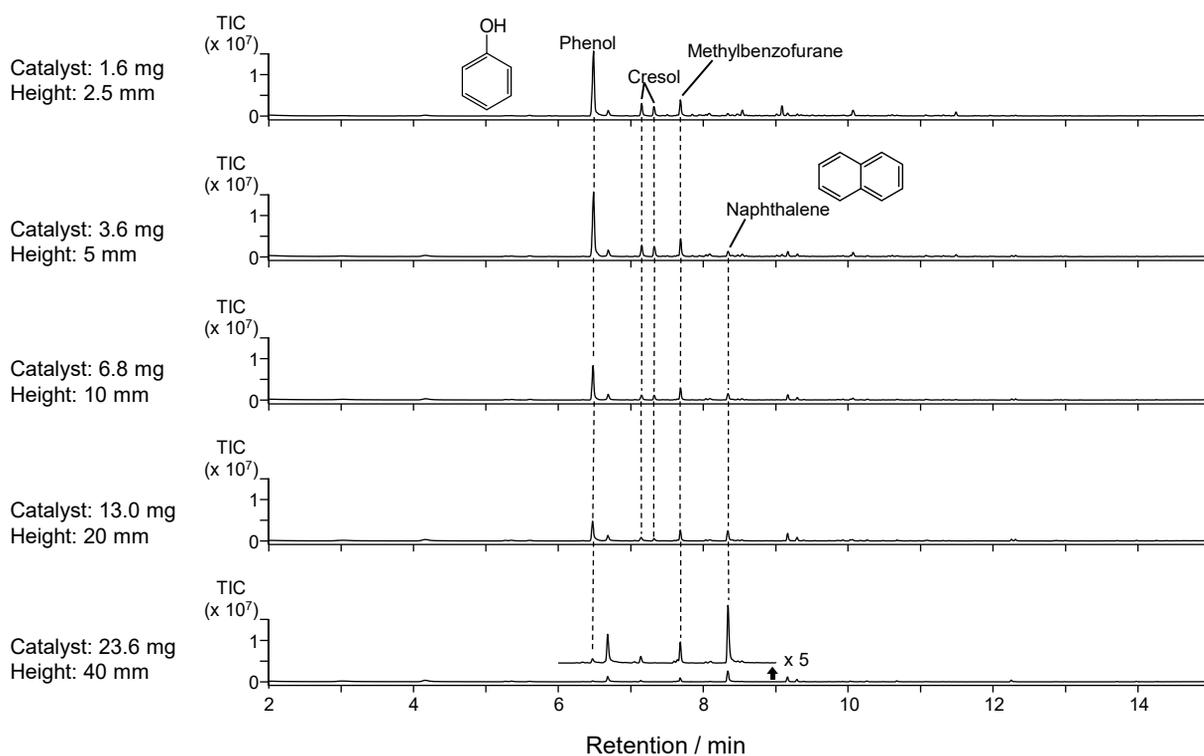


Fig. 1 Chromatograms of catalytic reaction products

Pyrolysis/catalyst reaction temp.: 500 °C, GC inj. temp.: 300 °C, GC oven: 40 (2 min hold) - 320 °C (20 °C/min), Split ratio: 1/100, Separation column: UA<sup>+</sup>-5 (5 % diphenyl 95 % dimethylpolysiloxane), L=30 m, i.d.=0.25 mm, df=0.25 μm, Column flow rate: 1 mL/min, MS scan range: m/z 29 - 550, Sample: 0.3 mg, Catalyst: BEA-92.5.

Ref. [K. Oshima et al., Ind. Eng. Chem. Res. 59 \(2020\) 13460–13466](#)

**Keywords :** Plastic recycles, CFRP, Zeolite catalyst

**Products used :** Multi-Shot Pyrolyzer, UA<sup>+</sup>-5, Vent-free GC/MS adapter

**Applications :** Plastic recycles, Catalyst screening

**Related technical notes :** [RXT-001E](#), [PYA1-116E \(Part 1\)](#), [PYA1-117E \(Part 2\)](#)

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