Characterization of aerosol released from the combustion of nanoparticle-containing materials

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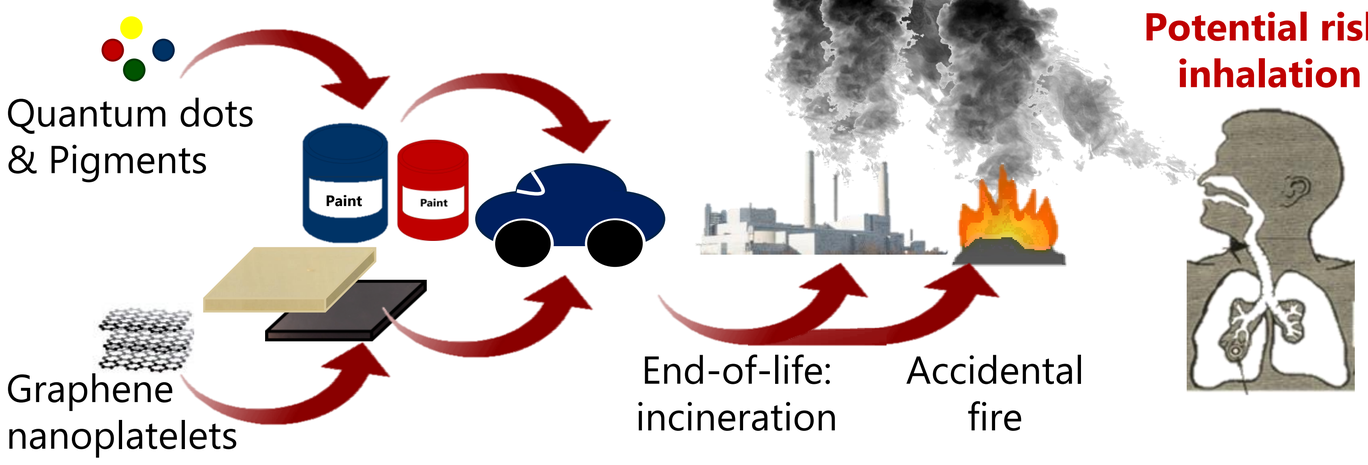
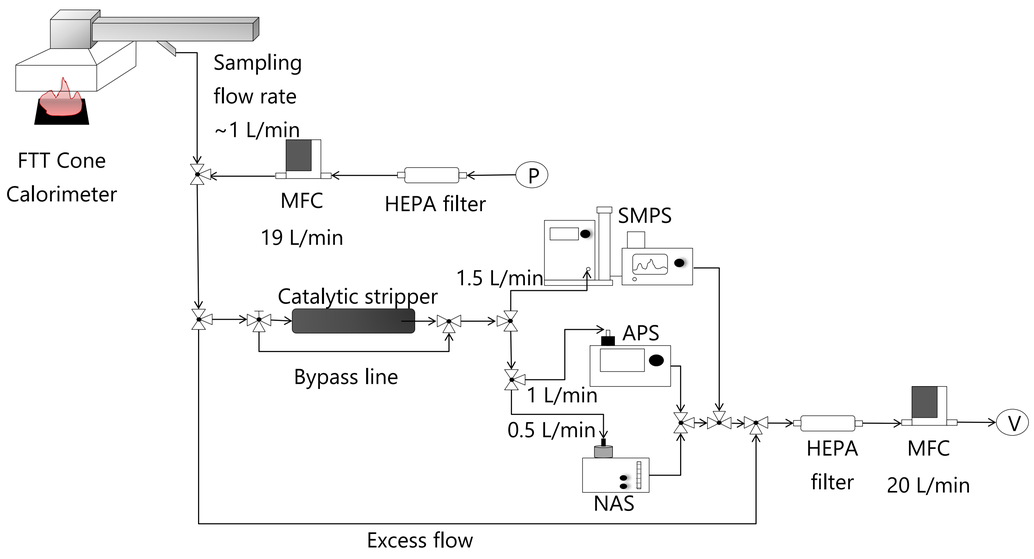
Background



- Since the studies focusing on characterization of the emissions from the combustion of nanoparticle-containing composites are still scarce and cover only limited types of nanoparticles, this study investigated the characterization of aerosol emissions from the combustion of different nanoparticle-containing composites.
- Nanofillers used in this study were graphene nanoplatelet (GNP), SiO_2, Ag nanowire and quantum dots.

Methodology

Characterization of particle size combusted aerosol particles



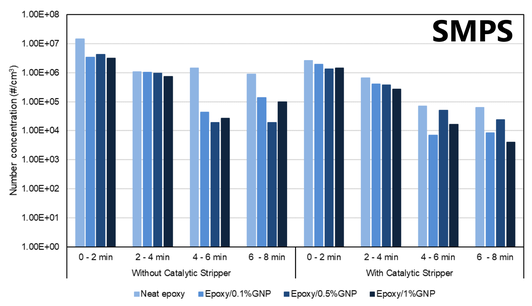
- Particle size distributions were analyzed on-line using
  - Scanning mobility particle sizer (**SMPS**, sampling interval 2 minutes per sample) and
  - Aerodynamic particle sizer (**APS**, sampling interval 20 s per sample).
- Nanometer aerosol sampler (**NAS**) was employed to collect the particles for SEM/EDX analysis.

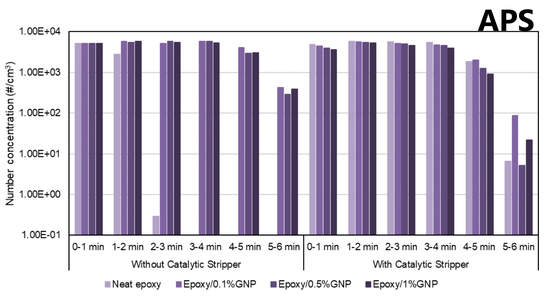
Characterization of volatile organic compounds (VOCs) from the combustion

- Two adsorbents: Carboxen and Tenax were used to collect emissions from the combustion with the flow rate of 100 mL/min.
- GC/MS equipped with thermal desorption unit was employed to analyze the VOCs from the collected emissions.

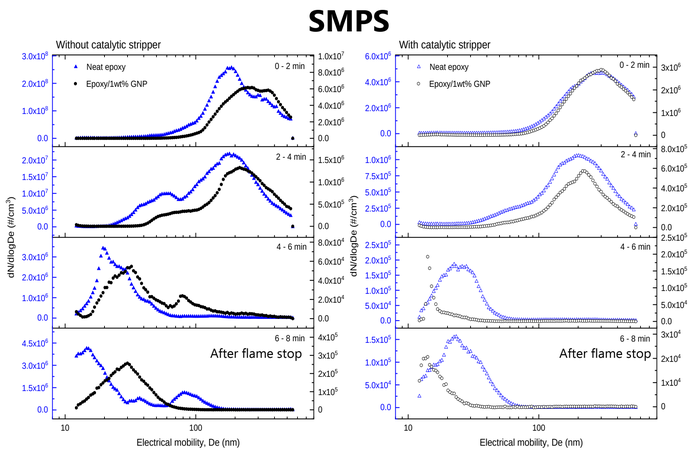
Results

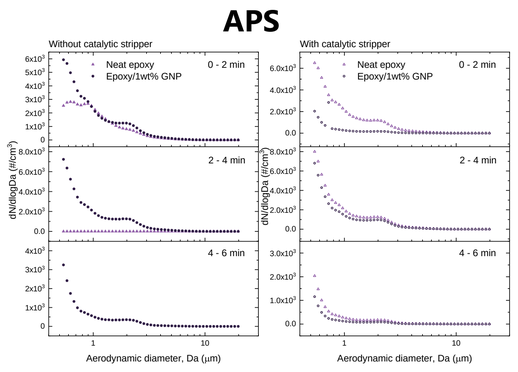
Particle number concentrations





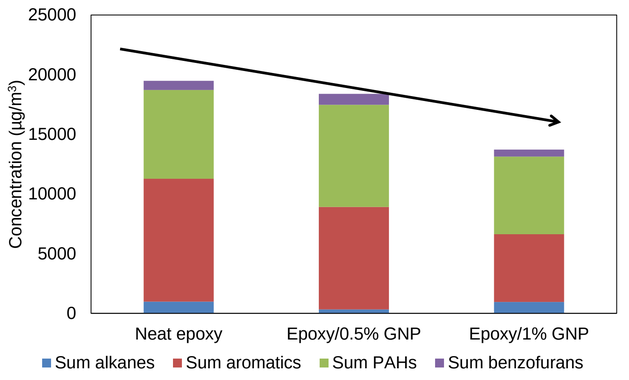
Particle size distributions



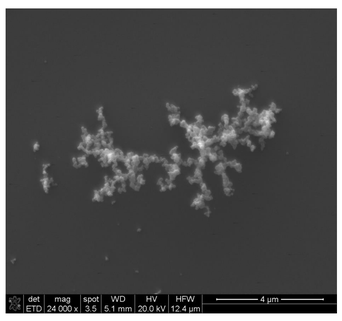


No particle was detected by APS after 6 minutes.

VOCs



SEM image of soot particles



Conclusions

- The implementation of the catalytic stripper did not have an effect on particle concentration.
- Adding GNP led to lower concentration of particle emissions, whereas particle size distributions were not influenced.
- Adding GNP resulted in a reduction of total emitted concentrations of VOCs.
- The main chemical families found included alkanes, aromatics, polycyclic aromatic hydrocarbons (PAHs) and benzofurans.

Outlook

- Further experiments will be performed using SiO_2, Ag nanowire and quantum dots as fillers in different polymer matrices including polyamide-6, polylactic acid and polyurethane.
- *In vitro* toxicity effects of the combusted products of these composites will be determined via air-liquid interface exposure to lung cells.

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