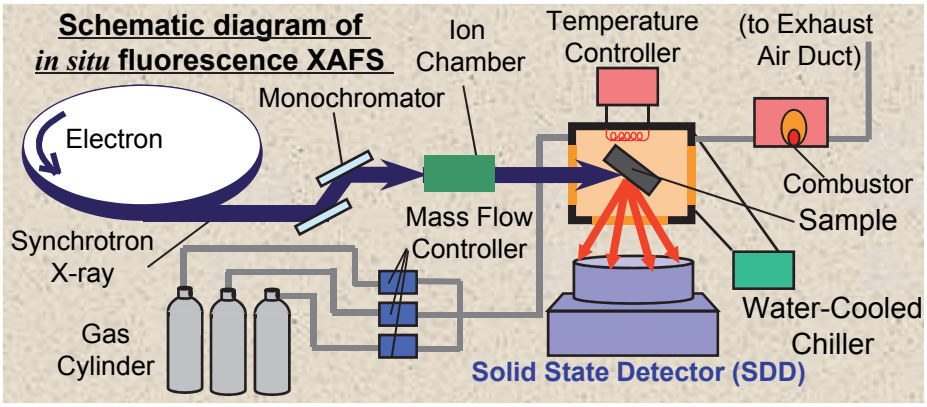
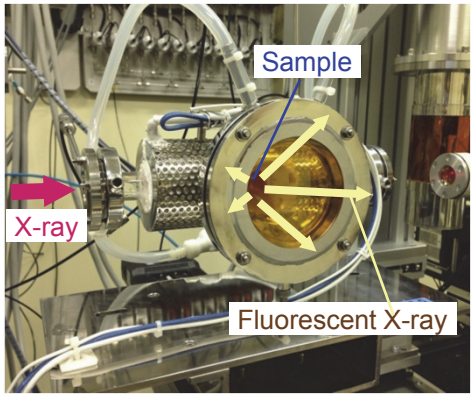
in situ Fluorescence XAFS analysis of Chemical State in a Small Amount of Metal Elements in Catalyses

in situ fluorescence XAFS enables to analyze chemical state of a small amount of metal elements in solid materials with high temperature and gas flow conditions. The methodology can reveal the dynamic behavior of chemical state of rare metal element platinum in automotive exhaust catalysts.

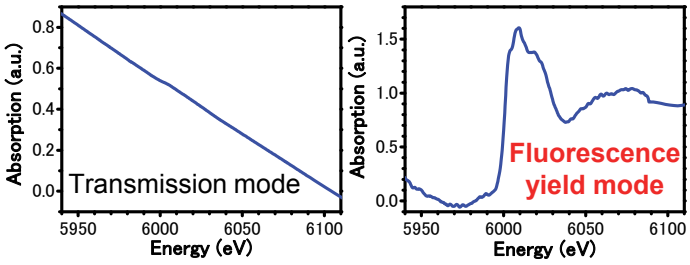
in situ XAFS (Fluorescence Yield Mode)





Transmission mode	Fluorescence yield mode
•More than about 1 wt% •Easy analysis	•Less than about 1 wt% •High sensitivity

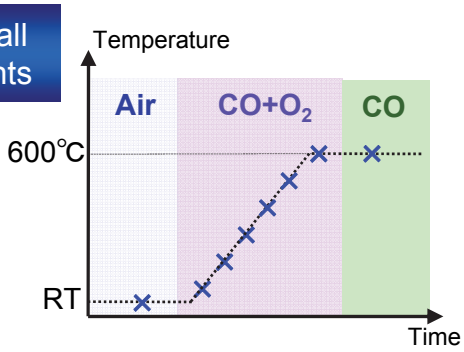
in situ fluorescence XAFS enables to analyze chemical state of a small amount of metal elements in solid state sample with high temperature and gas flow conditions.



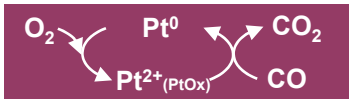
impurity Cr in polyester resin (30 ppm)

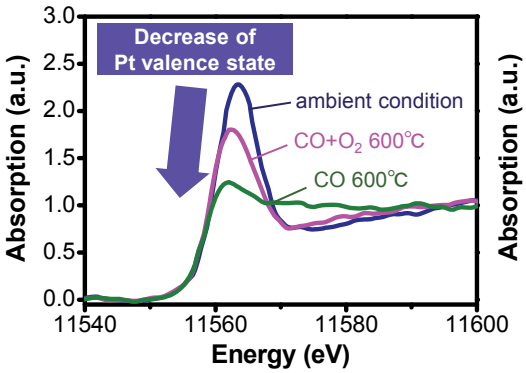
Chemical State in a Small Amount of Metal Elements

- Sample: Pt + Pd / CeO_2-ZrO_2 (Pt content: 0.25wt%)
- Absorption edge: Pt L_3-edge
- Temperature: RT ～ 600℃
- Gas concentration: CO 1 %+O_2 0.5 % or CO 1 % (N_2 balance)

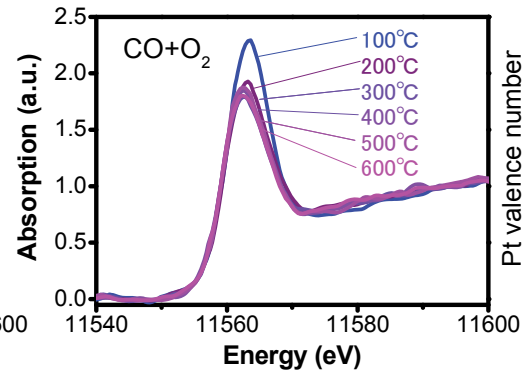


The heating in CO combustion condition with O_2 produced the reduction of platinum from Pt^{2+} to Pt^{4+} at 200˚C. And CO flow caused further reduction to Pt metal state. These results indicate the burning reaction with the catalytic cycle as described below.

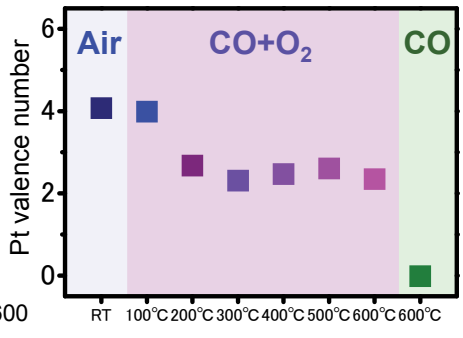




Pt L_3-edge XANES dependent on gas composition



Pt L_3-edge XANES dependent on temperature



Pt valence number from XANES

XAFS measurements with heating and gas flow conditions enable to investigate the chemical state with synthesis of condensed matter and heat durability as well as catalytic reaction.