Radical Chemistry in Oxidative Dehydrogenation of Propane over Boron Nitride

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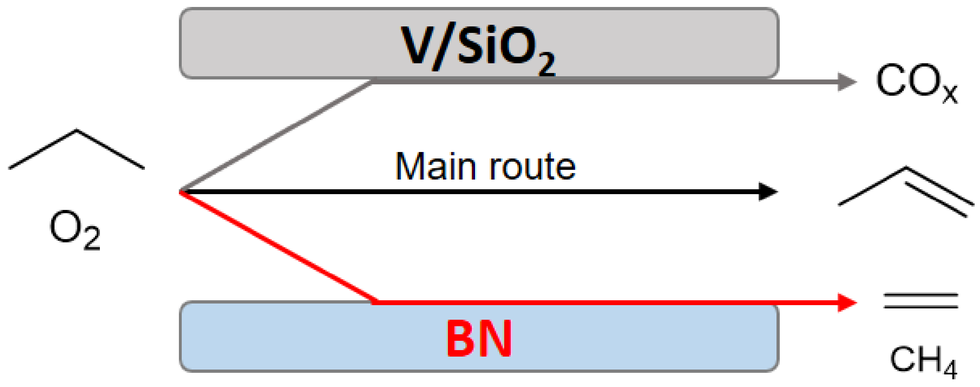
Motivation

Oxidative dehydrogenation of propane (ODHP)

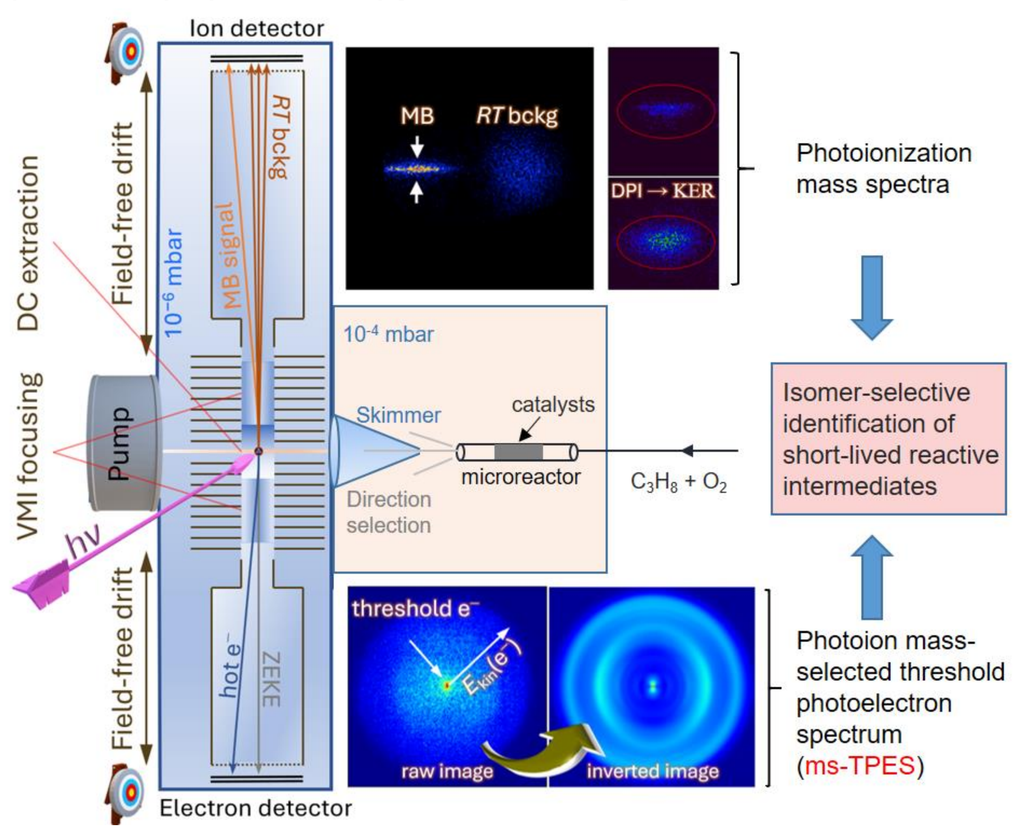


(1) Main byproducts are CO_x (CO, CO_2) on V-based catalysts, but are ethylene and methane in ODHP.
(2) Peculiar kinetic features on boron nitride (BN) implies the existence of gas-phase radical reactions.

Issue: Radical chemistry in OHDP over BN is not well identified experimentally.

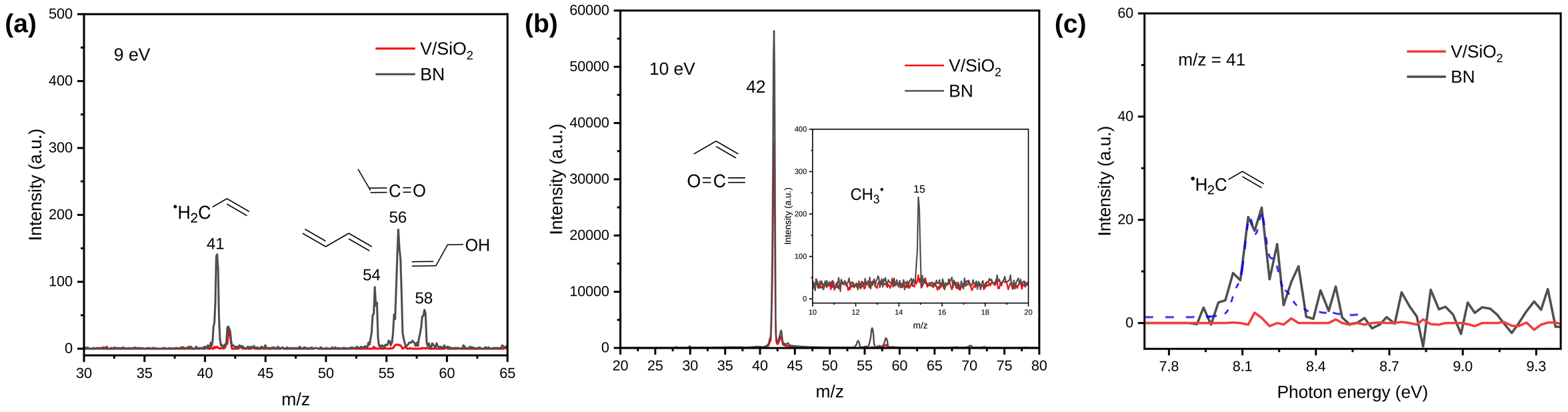
Experimental approach

Operando synchrotron photoelectron photoion coincidence (PEPICO) spectroscopy at Swiss Light Source of PSI

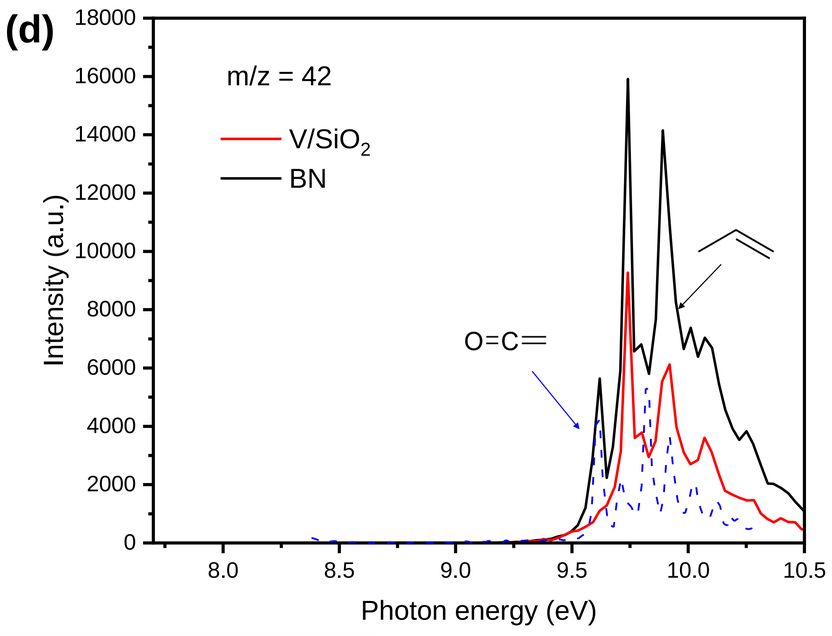


Results

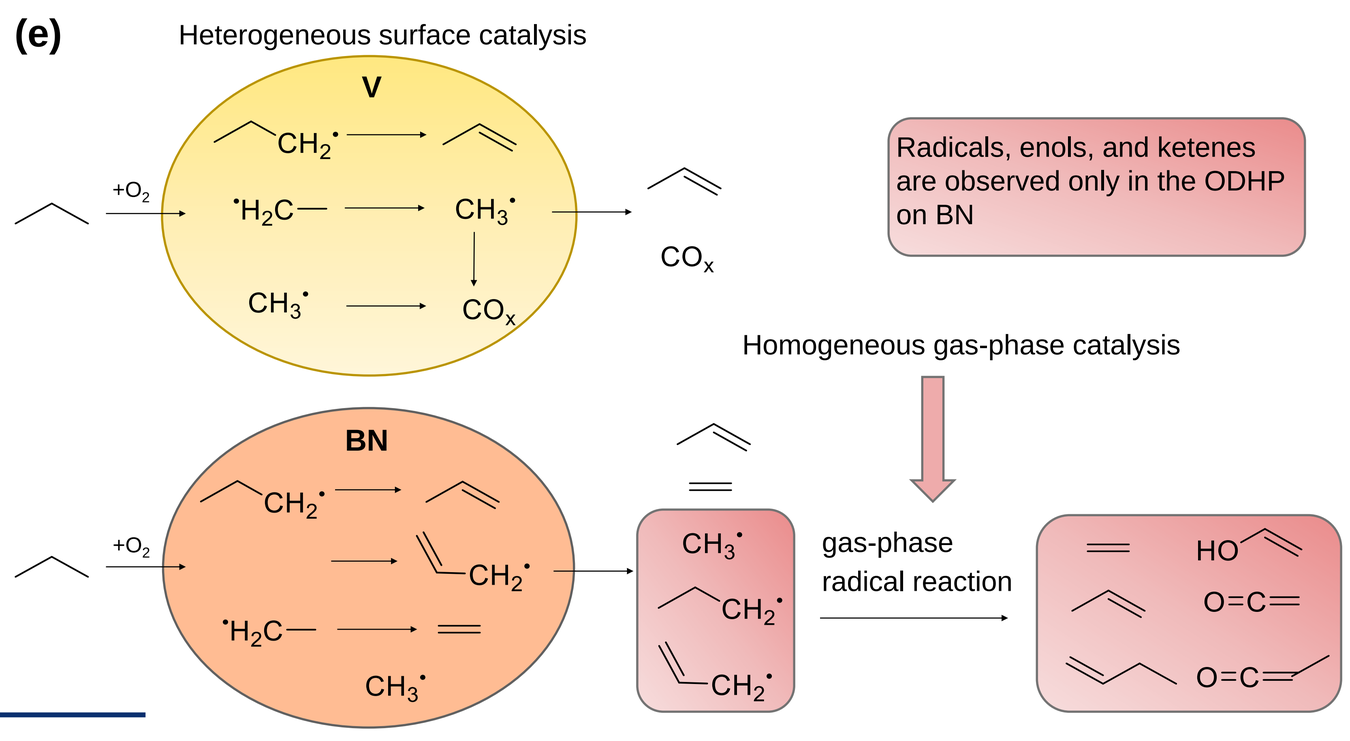
Mass spectra of ODHP on BN and V/SiO_2 catalysts at **(a)** 9 eV and **(b)** 10 eV at 650 °C **(c)** ms-TPES of m/z 41



(d) ms-TPES of m/z 42



(e) The proposed reaction route for ODHP on V and BN catalysts



Conclusions

- Gas-phase radicals were only observed for ODHP on BN, including methyl and allyl radicals at 650 °C, as well as 1-propyl radical at higher reaction temperature.
- Radical chemistry on BN contributes to the formation of oxygenates (ketenes and) and value-added C_4.

Acknowledgement

PSI CROSS project funding initiative and National Centre of Competence in Research funded by the Swiss National Science Foundation are gratefully acknowledged.