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New Trends and Challenges for Air Quality Control

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SPINEL FERRITE GAS SENSORS



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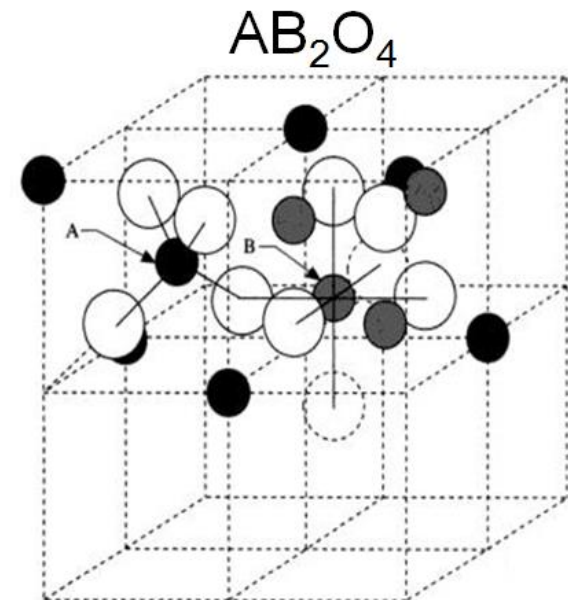
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Why spinel ferrites?

	Transition metal oxide gas sensors	Post transition metal oxide gas sensors
Compounds	$\alpha\text{-Fe}_2\text{O}_3$, WO_3 , TiO_2	ZnO , SnO_2 , In_2O_3
Sensitivity	Very high	High
Stability	Low	High

Spinel ferrites are complex metal oxides ($\text{M}^{2+}\text{Fe}_2^{3+}\text{O}_4$) with two different cation sites in structure for either transition or post-transition cation occupation



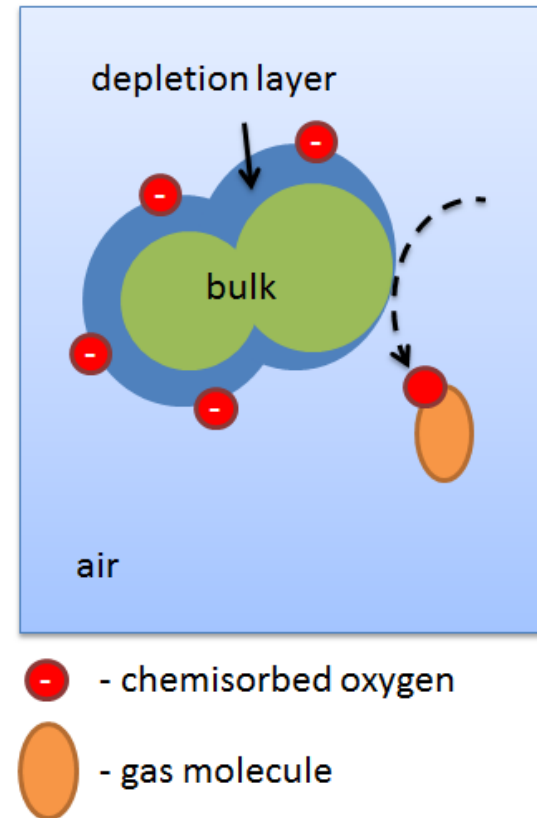
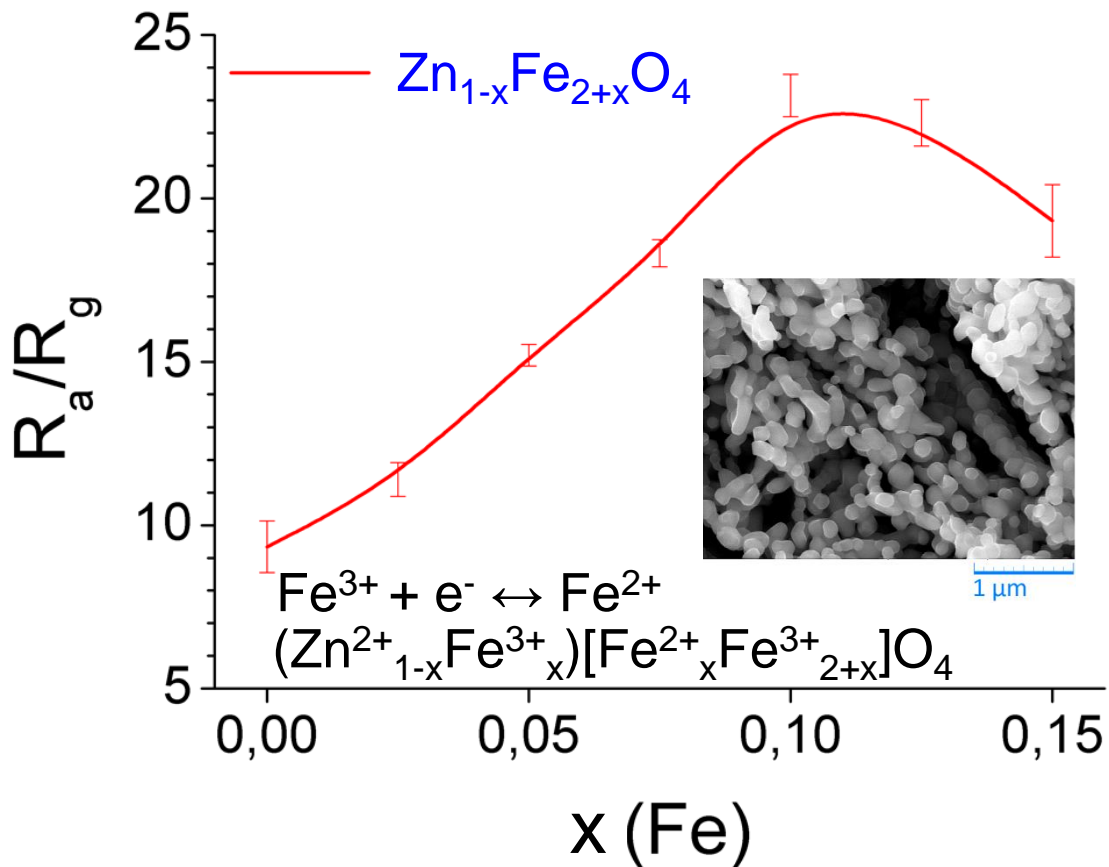
Why spinel ferrites?

Advantages for spinel ferrites:

- Transition and post transition metal cations can be combined
- Flexibility for combination of many different cations in one compound ($\text{Ni}_x\text{Zn}_y\text{Cu}_{1-x-y}\text{Fe}_2\text{O}_4$)
- Easy to control stoichiometry
- Possible to vary type of conductivity
- High chemical stability

Bring new possibilities for gas sensor material design!

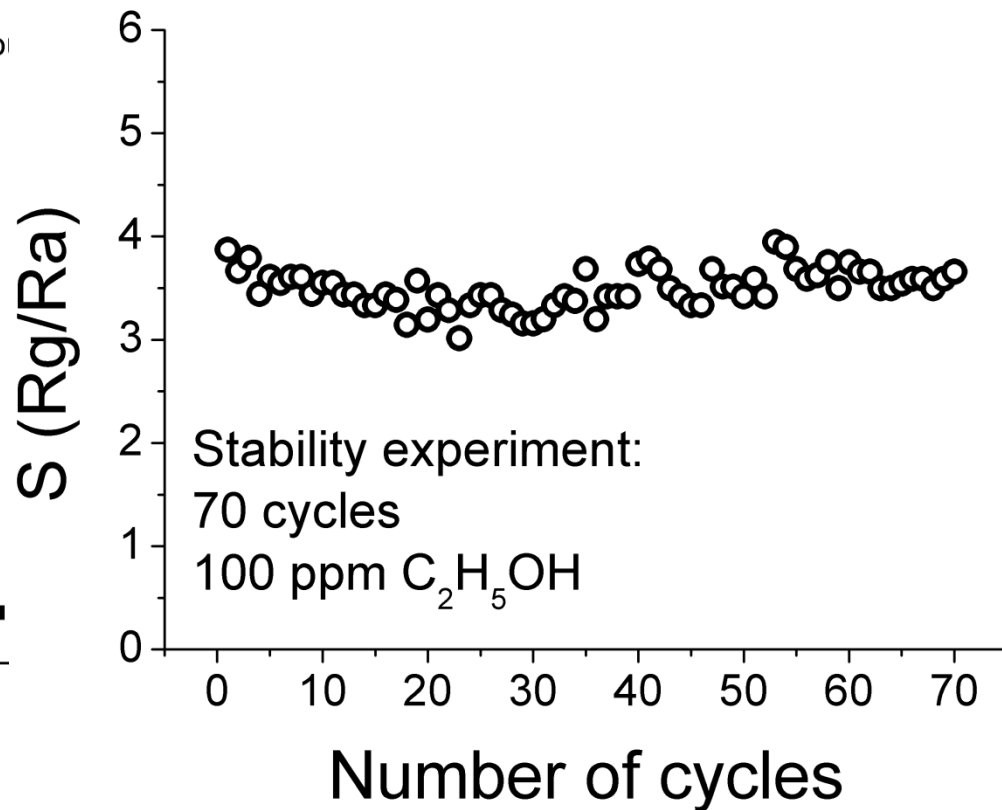
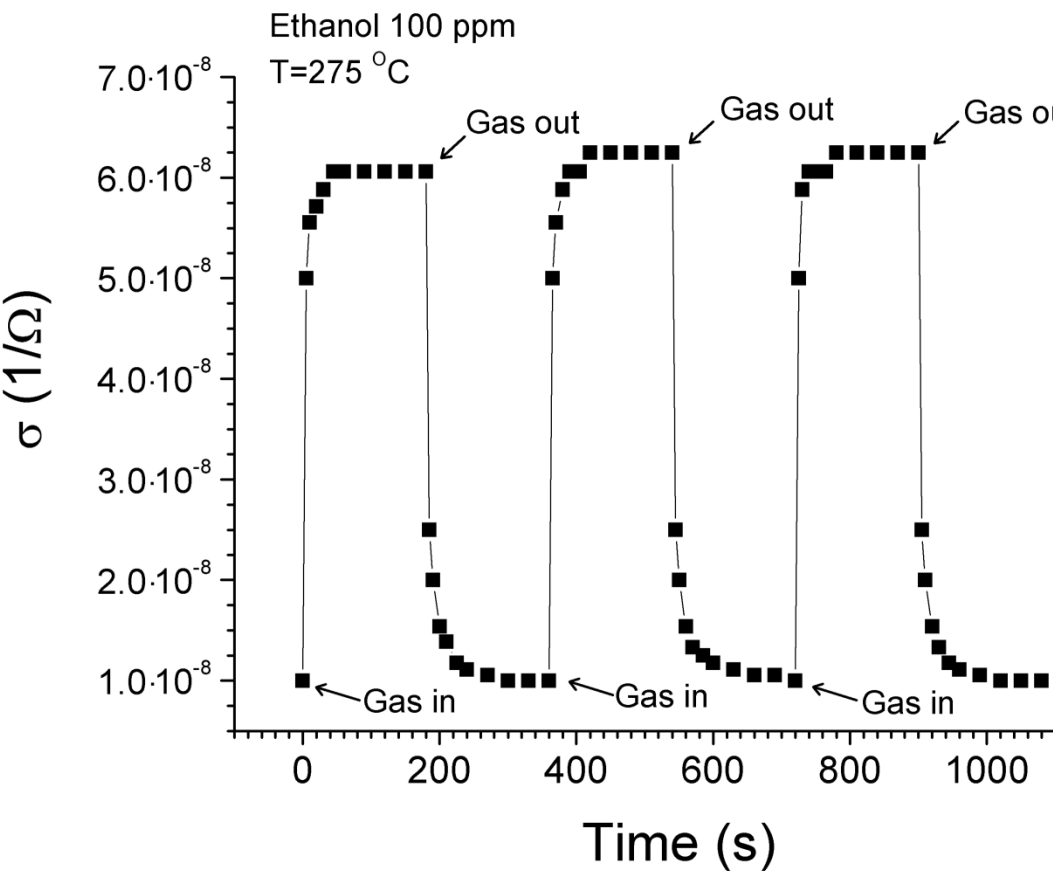
ZnFe₂O₄ gas sensor



Controlling the ratio between free e⁻ concentration and depletion layer width

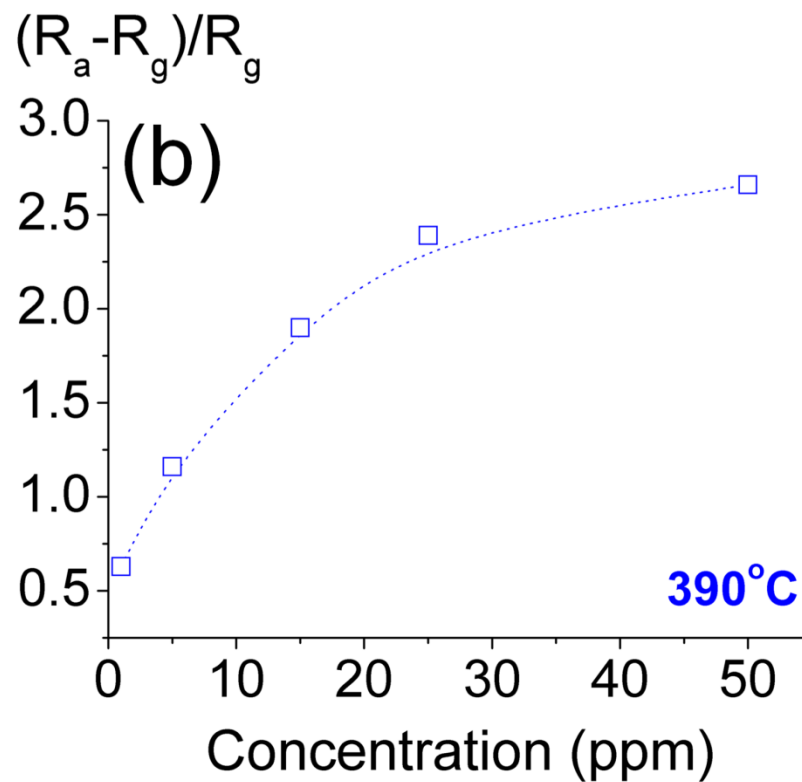
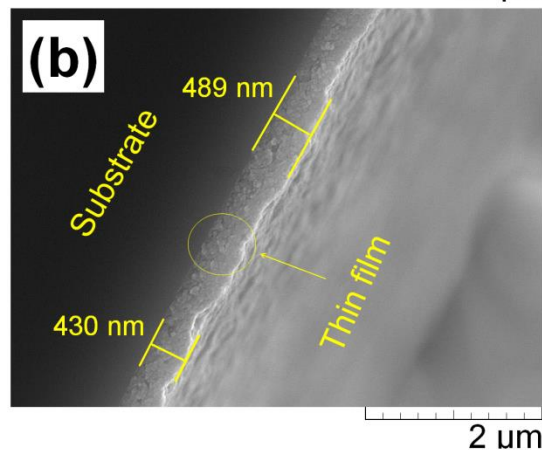
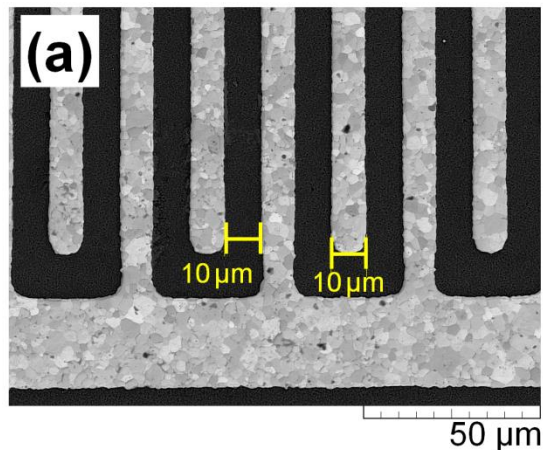
A. Šutka et al. Sens. Actuat. B 171– 172 (2012) 204– 209

ZnFe₂O₄ gas sensor



A. Šutka et al. *Ceramics International* 39 (2013) 8499–8502

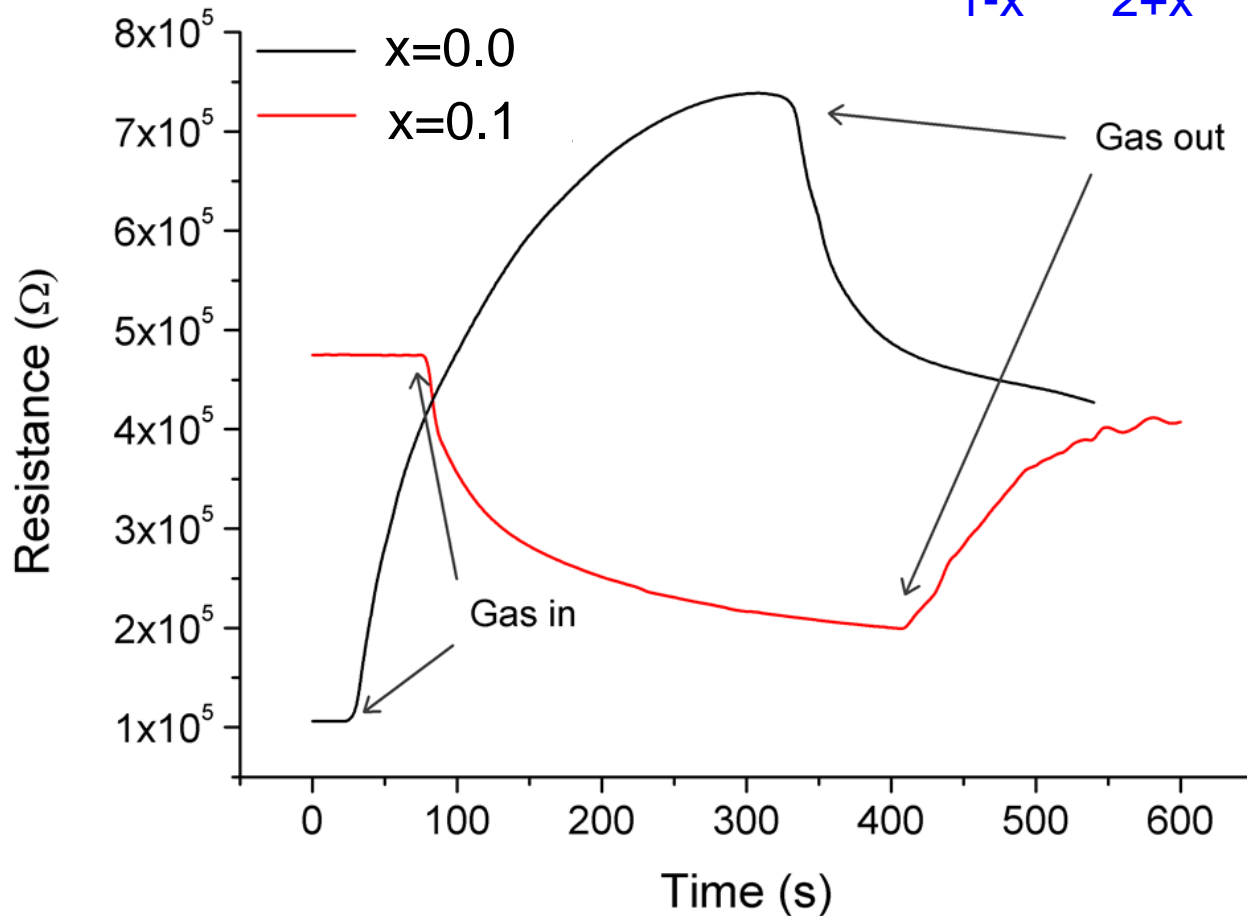
ZnFe₂O₄ gas sensor



Responsive to VOCs at low concentrations!

A. Šutka et al. Sensors and Actuators B 176 (2013) 330–334

NiFe₂O₄ gas sensor



Change type of conductivity by changing stoichiometry!

A. Šutka Sensor Letters 11 (2013) 2010-2013

Conclusions

- Spinel ferrites are versatile gas sensor materials
- Spinel ferrites bring new possibilities for gas sensor material design
- Spinel ferrites have relatively high gas response
- Spinel ferrites are potentially stable