Single Breath Analysis Diagnostics

P. I. Gouma

Center for Nanomaterials & Sensor Development
State University of New York

Email:pgouma@notes.cc.sunysb.edu

STONY BROOK
STATE UNIVERSITY OF NEW YORK

TIMELINE OF BREATH ANALYSIS

Hippocrates of Cos (ca. 460 BC – ca. 370 BC) – father of modern medicine

1972
Orthomolecular medicine

2000
Nanotechnology for prevention, early detection and treatment of disease

CAPTURE YOUR BREATH

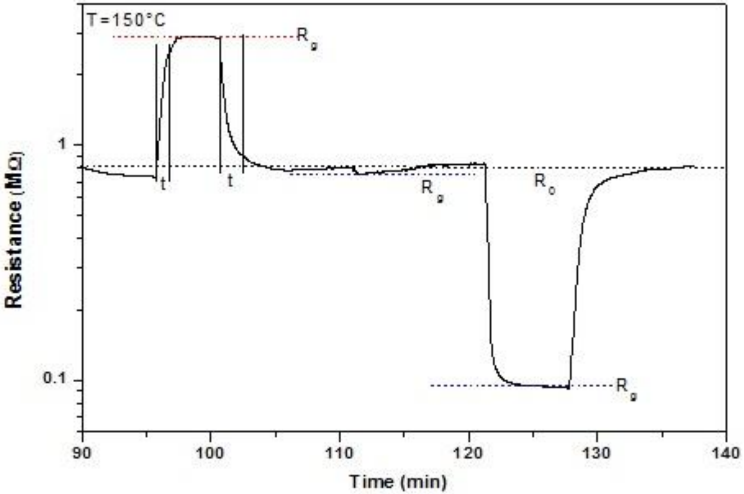
- Over 300 compounds
- Trace Concentrations
- Sampling Issues

THE SOLUTION

- Selective Sensing Elements to Signaling Metabolites
- Sensors with Extreme Sensitivity
- Single Breath Sampling Devices

I. SELECTIVE NANOSENSORS

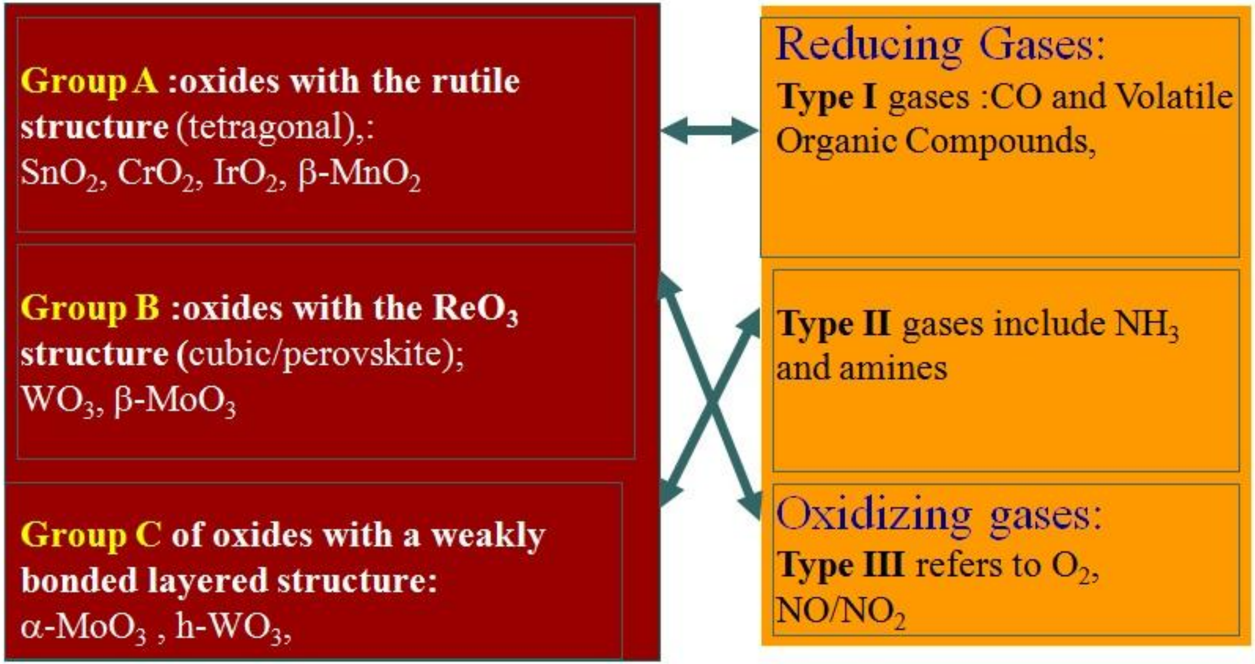
Crystallo-Chemical Approach to Gas - Metal Oxide Interactions



A chemo-resistive gas sensor is a device which reacts with its surrounding gas and converts this reaction into the change of resistance of the device in a distinctive manner

SEMI-EMPIRICAL MAP OF GAS-OXIDE INTERACTIONS

P. I. Gouma, "", *Rev.Adv. Mater. Sci*., 5, pp. 123-138, 2003



Principle of Specificity for Resistive Chemosensors

PHASE FIELDS

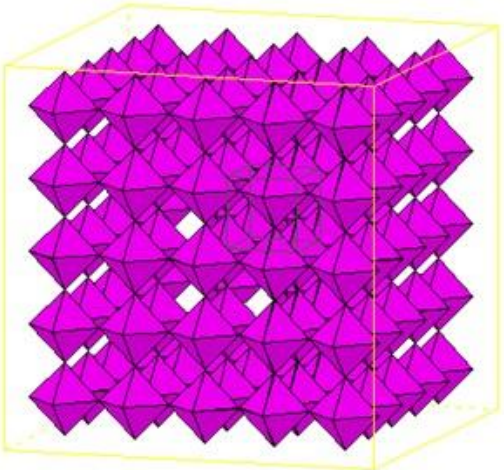
Nanotechnology offers toolbox of new or metastable phases

- Stable phases

WO_3

- A distortion of ReO_3-like structure

- From *α* phase to *δ* phase, such distortion occurs between two adjacent $[WO_6]$ units.



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(12) United States Patent
Gouma

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(45) **Date of Patent:** **Mar. 28, 2006**

(54) **SENSORS INCLUDING METAL OXIDES SELECTIVE FOR SPECIFIC GASES AND METHODS FOR PREPARING SAME**

(75) Inventor: **Pelagia-Irene Gouma**, Port Jefferson, NY (US)

(73) Assignee: **The Research Foundation of SUNY at Stony Brook**, Stony Brook, NY (US)

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A SELECTIVE AMMONIA SENSOR

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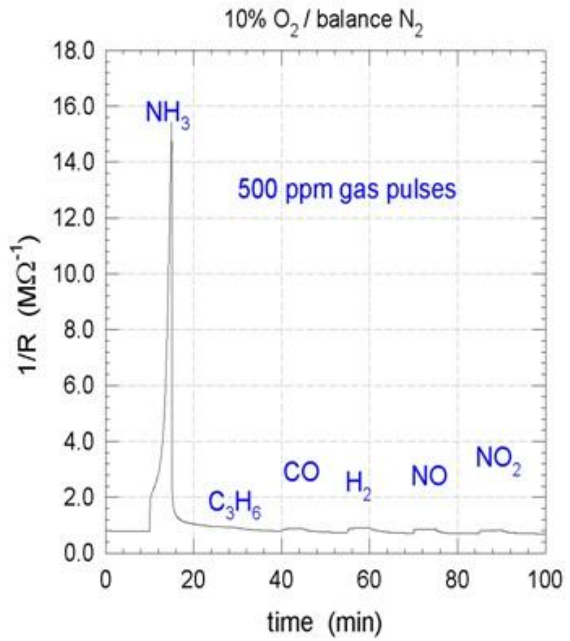

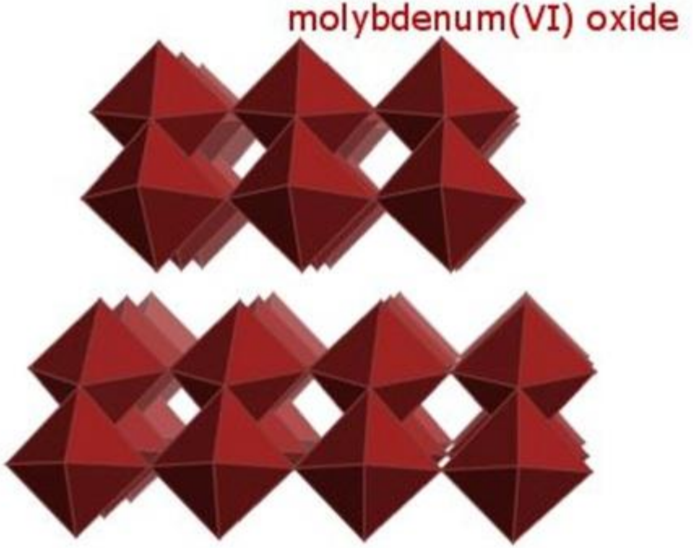

Developed initially for selective catalytic reduction systems/urea monitoring

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Electrospun biocomposite nanofibers for urea biosensing

Katarzyna Sawicka[a,*], Perena Gouma[b], Sanford Simon[c]

[a] *Department of Chemistry, Stony Brook University, Stony Brook, NY 11790, USA*
[b] *Department of Material Science and Engineering, Stony Brook University, Stony Brook, NY 11790, USA*
[c] *Departments of Pathology and Biochemistry, Stony Brook University, Stony Brook, NY 11790, USA*

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Abstract

Urease E.C.3.5.1.5 acts as a catalyst in the hydrolysis of urea to ammonia and carbon dioxide. Presence of this enzyme can increase the rate of reaction by 10^{14}.

Urea levels are vital in medical diagnosis, environmental and bioindustrial analysis. This paper presents an innovative technique for enzyme immobilization. Nanocomposite fibers of urease and polyvinylpyrrolidone (PVP) were prepared by the electrospinning technique. The non-woven mat formed has potential as a urea biosensor. Its advancements over prior technology are faster response time, sensitivity to lower concentrations of urea, and a more versatile design.

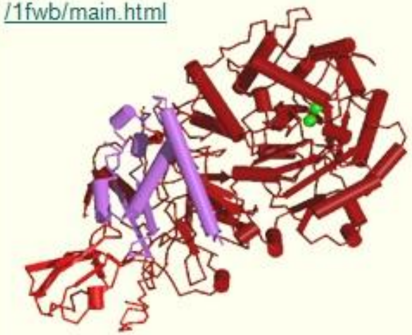
Keywords: Electrospinning; Biosensing; Urea; Urease; Nanofibers; Nanocomposite

Hydrolysis of urea by urease

Urease is an enzyme produced, among other ways, by H-Pylori bacteria

Urease catalyzes the hydrolysis of urea to ammonia and carbon dioxide

http://www.biochem.ucl.ac.uk/bsm/pdbsum/1fwb/main.html



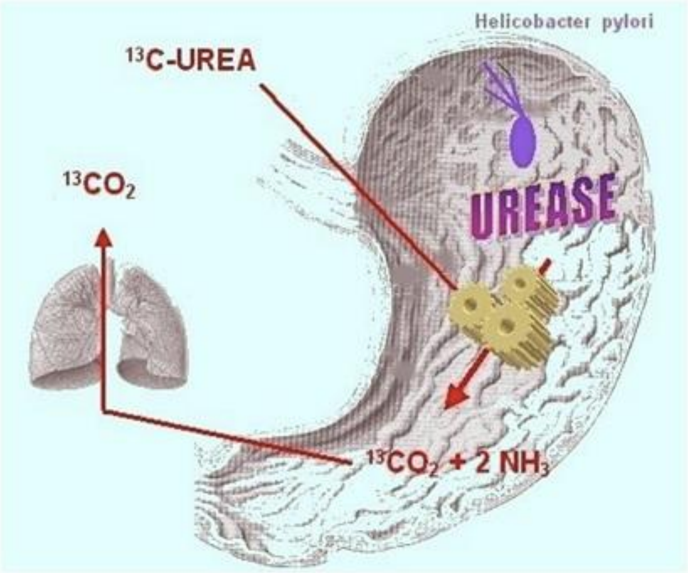
$$CO(NH_2)_2 + H_20 \xrightarrow{\text{UREASE}} CO_2 + 2NH_3$$

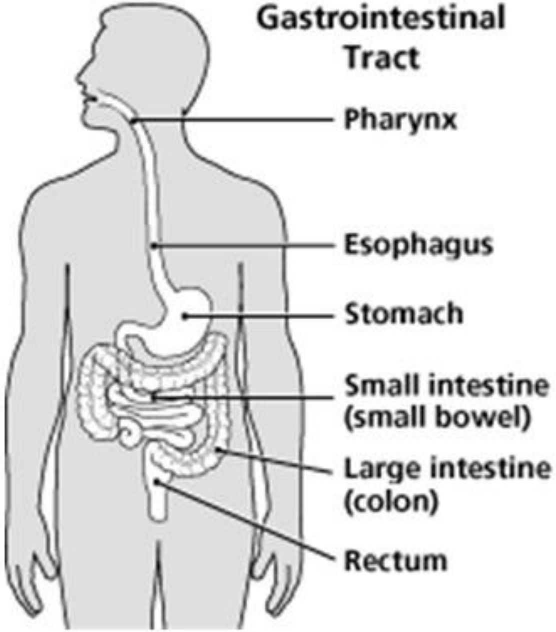
Urea Breath Test

Those infected with H-pylori may consume urea and monitor the change in exhaled ammonia or carbon dioxide to identify the infection

CONVENTIONAL UREA BREATH TEST

Current urea breath test for H-pylori detection uses urea labeled with radioactive C14





http://193.206.95.3/html/Web%20breath%20test/Urea.jpg