Quantalyx

Precision Sensing for Catalytic Innovation

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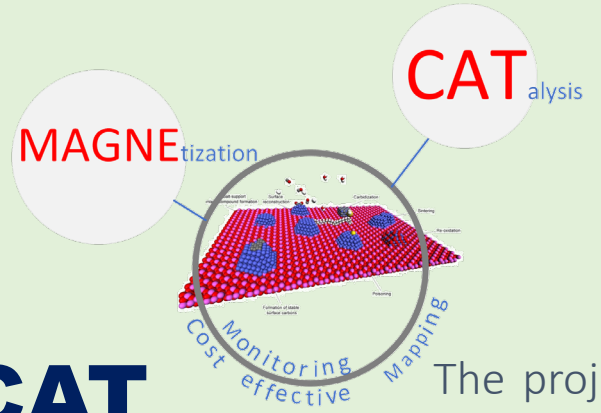
A Spin-Off company based on ***MAGNECAT*** Project



MAGNECAT

Magnetism in Heterogeneous
Catalysis & Reaction Kinetics

ΕΛΙΔΕΚ
Ελληνικό Ίδρυμα Έρευνας & Καινοτομίας

The project is funded by **HFRI (Hellenic Foundation for Research & Innovation)** with main objective the measurement of magnetic fields generated inside working catalytic reactors.

Hellenic Mediterranean University (HMU) is hosting the action.

MagneCat is a two-year project with a budget of 200K€ for support of young academics (similar to the YFT).

What?

- Objective of MagneCat is to combine catalysis science and technology together with the technology of the evaluation of small magnetic fields for space applications. In order to probe the birth and death of magnetic phases inside working catalytic reactors.

Why?

- Probe and decouple complex deactivation mechanisms of catalysts, which are current limitations in catalysis monitoring, Lack of real-time, non-invasive sensing solutions and Inefficiencies in R&D and industrial processes.

Where?

- Initially at bench scale reactors, envisioning to level up to industrial scale.

How?

- By an array of fluxgate sensors monitoring magnetic fields generated and degenerated under cyclic reduction oxidation processes with heuristic and ML algorithms for data analysis.

Why?

- More than 80% of the chemical products used today pass from at least one catalytic process
- Catalyst deactivation is often the limiting factor for technologies reaching the commercial scale
- Several mechanisms interplay and therefore there is a need for advance materials characterization studies applied in situ or operando
- Today these studies are conducted by utilization of advance electromagnetic radiation at synchrotrons (electron accelerators), **expensive**!!

Technology Overview

Origin: University research

IP: Patent submission process

Core tech: Magnetic field detection linked to reaction dynamics

Challenges that we address

Knowledge → in added value creation chemical industry - understanding in catalysis science

Catalysis has become a multibilion dollar bussines Handbook of Heterogeneous Catalysis

Analytics → Creation of a compact versatile device

Allowing monitoring of chemical reactors in situ at a fraction of a cost. Compering to competition Sasol/UCT device at the cost of 1 mil € Sasol – UCT

Targeting Analytical market (Altamira, micromeritis, ILS, PID, etc)

Industrial services (Catalysis and chemical conversions)

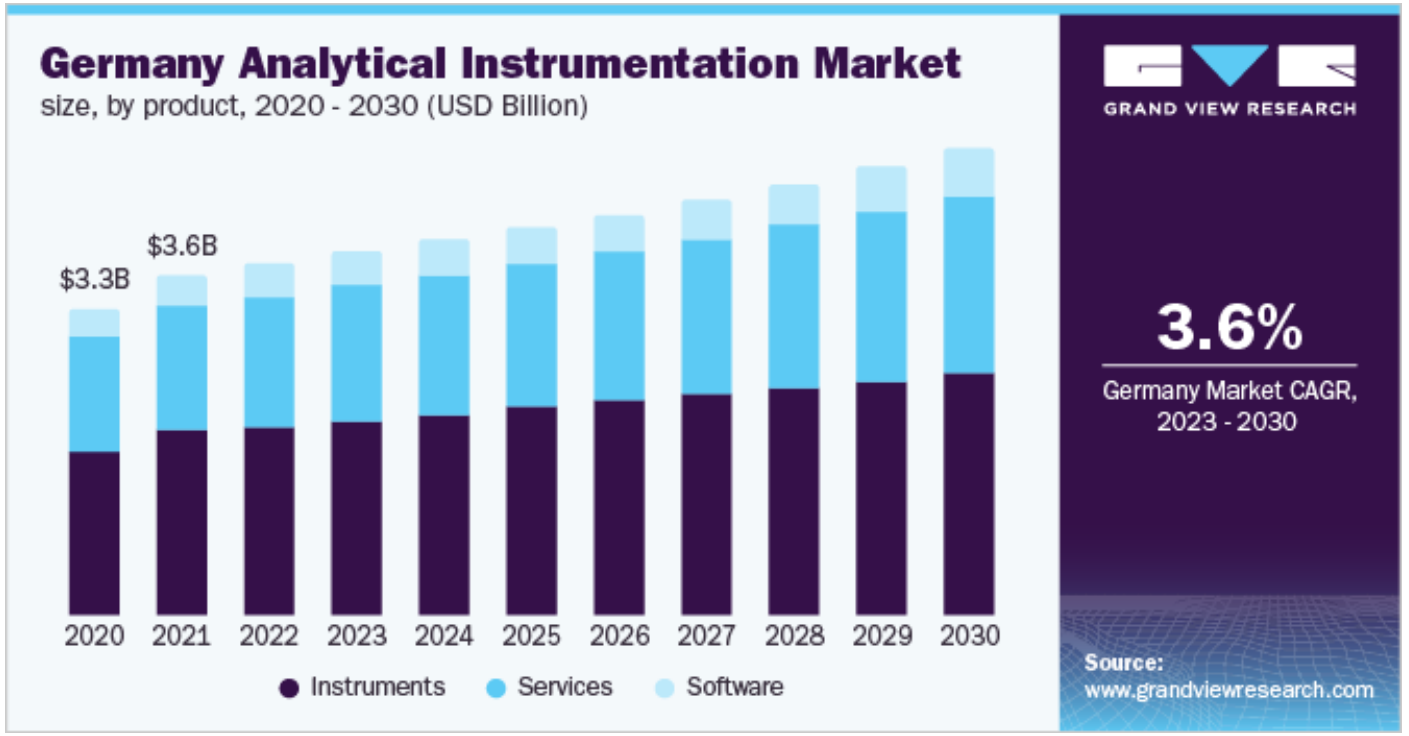
Meassurments on site . Hi tech Contracted services

Potential clients Yara, Shell, Topsoe, Sasol, JM, BP, Clariant, Ketjen

Market Opportunity – Examples of Impact

The global analytical instrumentation market is expected to grow at an annual growth rate of 3.53% from 2023 to 2030 to reach USD 70.09 billion by 2030. Europe has more than 210 Catalysis related laboratories and as such potential clients of a magnetometer device EFCATS.

Yara ammonia synthesis catalyst is iron based. Ammonia is the basic building block for feltizers that allows feeding of todays population. Yara has a capacity of 8.6 million tones of Ammonia per year YARA.



Approximately 2% of the world's fuel is created by GTL process (Shell and Sasol) on cobalt based catalysts [Nature]. Cobalt is the preferred catalytic material but is not cheap and deactivates with time (Tsakoumis). Therefore, it has to be replaced at regular intervals.
Even a minor 1% in the efficient utilization (i.e. productivity or selectivity) of the cobalt and iron catalysts above can potentially save millions. This can occur without any CAPEX but purely through valuable data that will be provided by our system.

Product and Business Model

Initial product: portable plug-and-play sensing module in lab-scale reactors

Future: integrated platforms – industrial scale, data analytics

Revenue: Direct sales, licensing, data services

Competitive Landscape

One competitor offers real-time magnetic sensing at lab-scale

Comparison: Accuracy, invasiveness, portability, low-cost, easy of integration on current reactors installations

Our edge: IP, platform potential, ease of integration, portability, Low-cost

Go-to-Market Strategy

Target early adopters: top-tier labs, Chem firms

Channels: direct outreach, academic partnerships

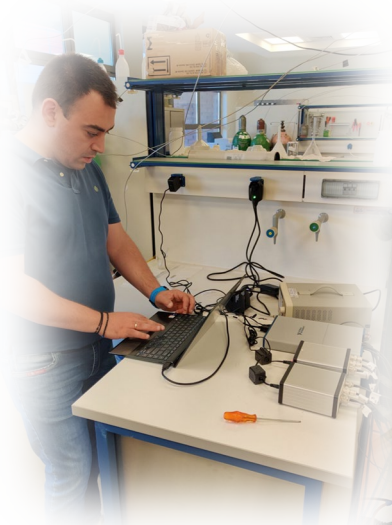
Milestones: pilot programs, beta launches

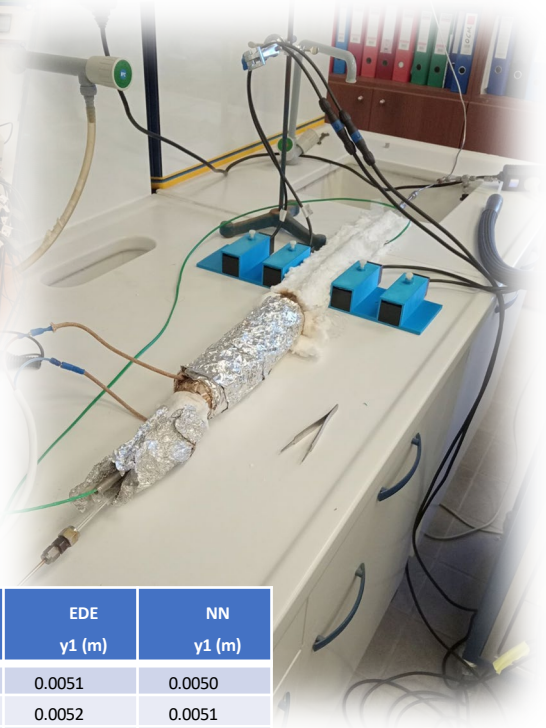
Vision / Impact

- ✓ Empowering smarter chemistry through precision sensing
- ✓ Enabling breakthroughs in catalysis, materials, and more
- ✓ Join us in transforming chemical discovery

Facts Sheet

Experimental – Set up (Prototyping)





***Technical University of Crete** is offering reactor infrastructure.

Catalyst

- ❑ 1-4g of catalyst. Max wt% of magnetic material Co, Ni, Fe
- ❑ Type of magnetism ferromagnetic or super paramagnetic
- ❑ Magnetic and nonmagnetic crystallite phases ratios
- ❑ Degree of reduction
- ❑ Co-Re/gAl2O3

Custom Algorithms Validated with Test Samples

Volumes from MFC to reactor and from reactor to detector

Gasses (MFC)

- ❑ H2 10-100%
- ❑ Air to 1-2%
- ❑ N2

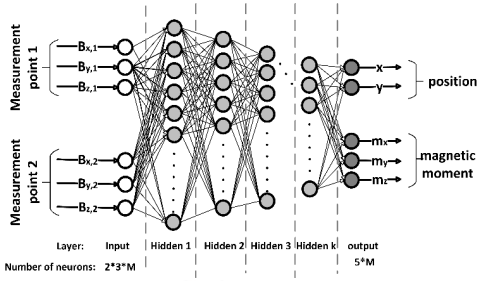
Heater T more than 350

- ❑ Coil based resistor
- ❑ IR Heater?

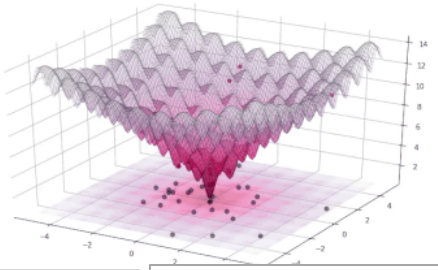
Detector H2/O2/CO2 (MS/GC)

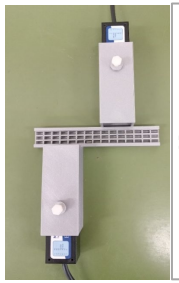
- ❑ Quantitative

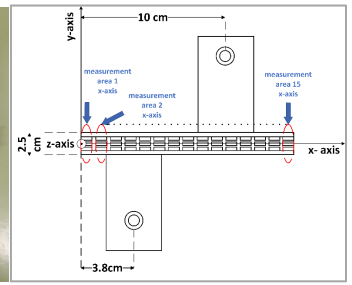
- ❑ Neural Networks

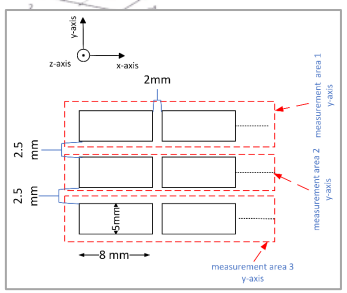


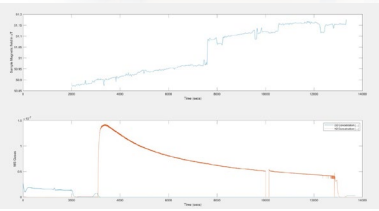
- ❑ DE - Stochastic Algorithm











Meas. area x-axis	EDE x (m)	NN x(m)	EDE y1 (m)	NN y1 (m)
1	0.0050	0.0051	0.0051	0.0050
2	0.0148	0.0150	0.0052	0.0051
3	0.0245	0.0236	0.0057	0.0056
4	0.0343	0.0329	0.0063	0.0058
5	0.0441	0.0435	0.0066	0.0064
6	0.0548	0.0547	0.0065	0.0064
7	0.0647	0.0642	0.0064	0.0064
8	0.0750	0.0750	0.0062	0.0066
9	0.0848	0.0841	0.0062	0.0066
10	0.0947	0.0952	0.0062	0.0065
11	0.1052	0.1054	0.0070	0.0069
12	0.1149	0.1141	0.0076	0.0076
13	0.1239	0.1230	0.0074	0.0072
14	0.1338	0.1338	0.0067	0.0065
15	0.1442	0.1458	0.0066	0.0062