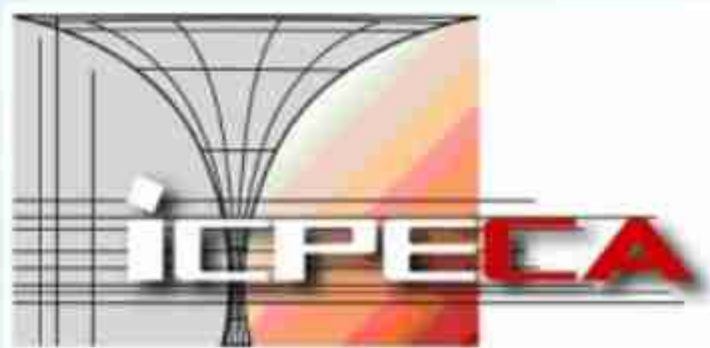



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**Static converter for supplying five-phase induction motors
and command method for the phase fault operation**

Authors:
**VASILE Ionuț, SBURLAN Ion-Cătălin, TUDOR Emil, CONSTANTIN Alexandru-Ionel,
DUMITRU Constantin**

Patent application No. A/00254/14.05.2021



Abstract
The present invention refers to a static power converter with five phases that supplies a five phase induction motor and the control method used in case a phase fault happens.

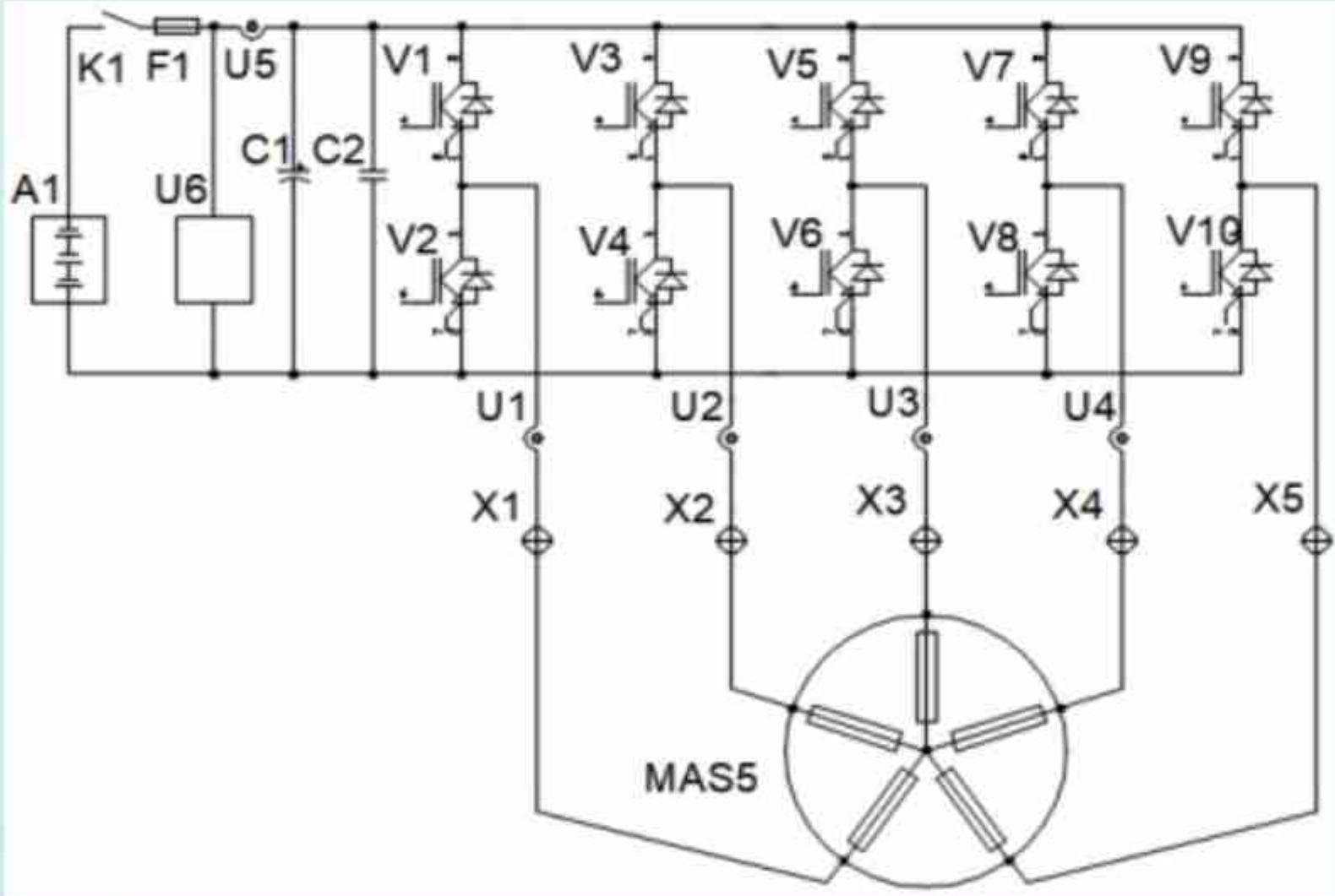
Applications
The range of application this converter covers includes electric traction drives, hoisting equipment, overhead cranes and elevators, electric boats, electric planes and basically, any application where the electric drive is a critical component to the safety operation of the equipment, where a fault can interrupt the operation of the equipment leading to safety hazards for the operators or to negative economic consequences.

Technical problem
The technical problem this invention solves is the supply of a five phase induction motor in normal operating conditions as well as in the case of a phase fault.

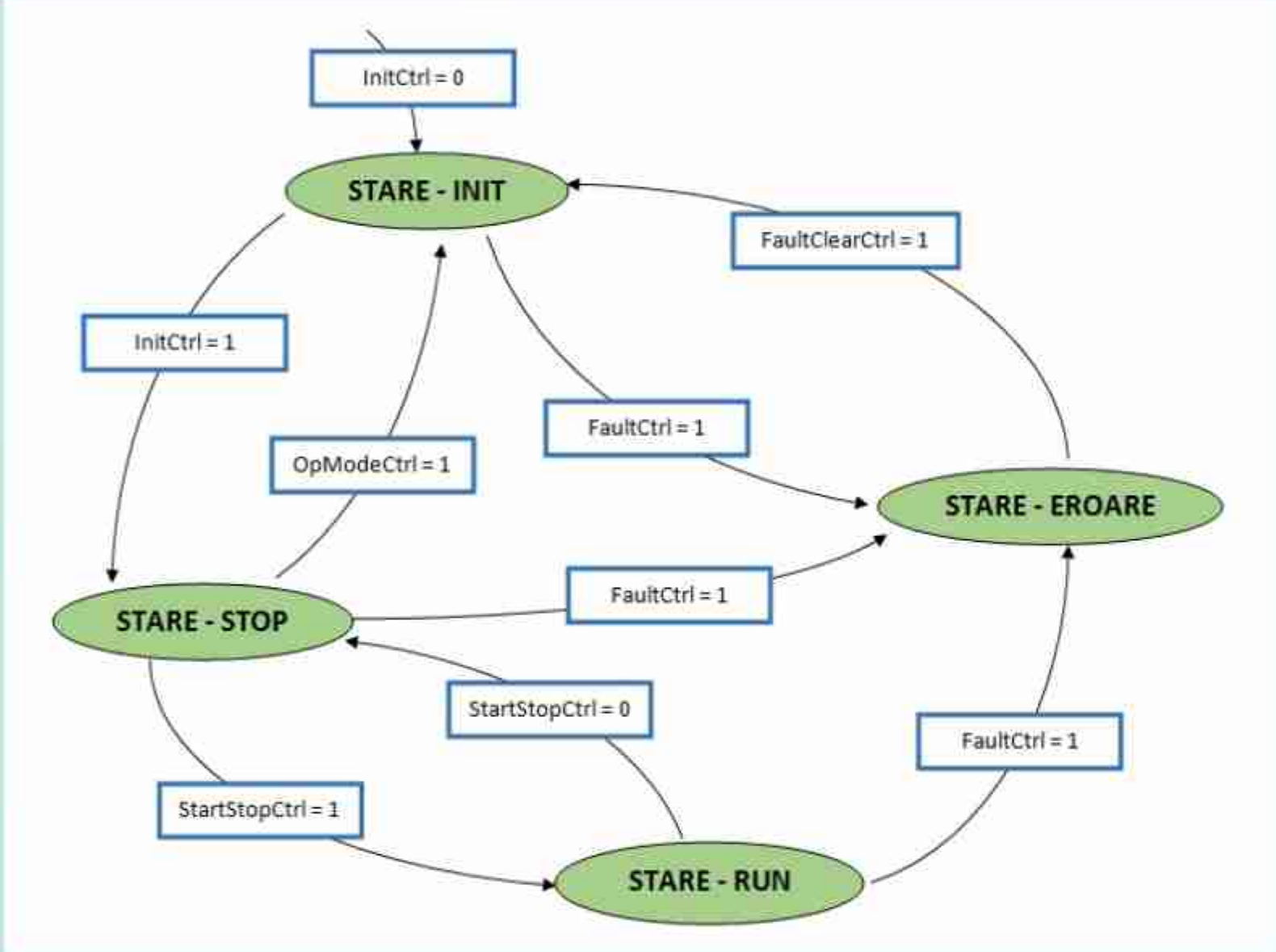
Technical solution
In such condition, the control block of the converter will automatically detect the fault and will make the necessary correction to the control signals of the converter so that the motor can still drive the load with reduced power output. This correction is done by changing the phase angles of the voltage vectors supplied to the motor in order to compensate the missing faulty phase.

Main characteristics
Five phase inverter

- IGBT transistors technology,
- LEM high precision voltage sensor,
- CSNR current sensor,
- 24Vdc to +5/+15/-15Vdc supply,
- Semikron drivers with fault protection,
- PDB-01 motherboard,
- ARM Cortex M3 processor.




Five phase inverter schematic with five phase induction motor load




State diagram for five phase inverter control

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Code C:
ELECTRONICS □ ELECTRICITY



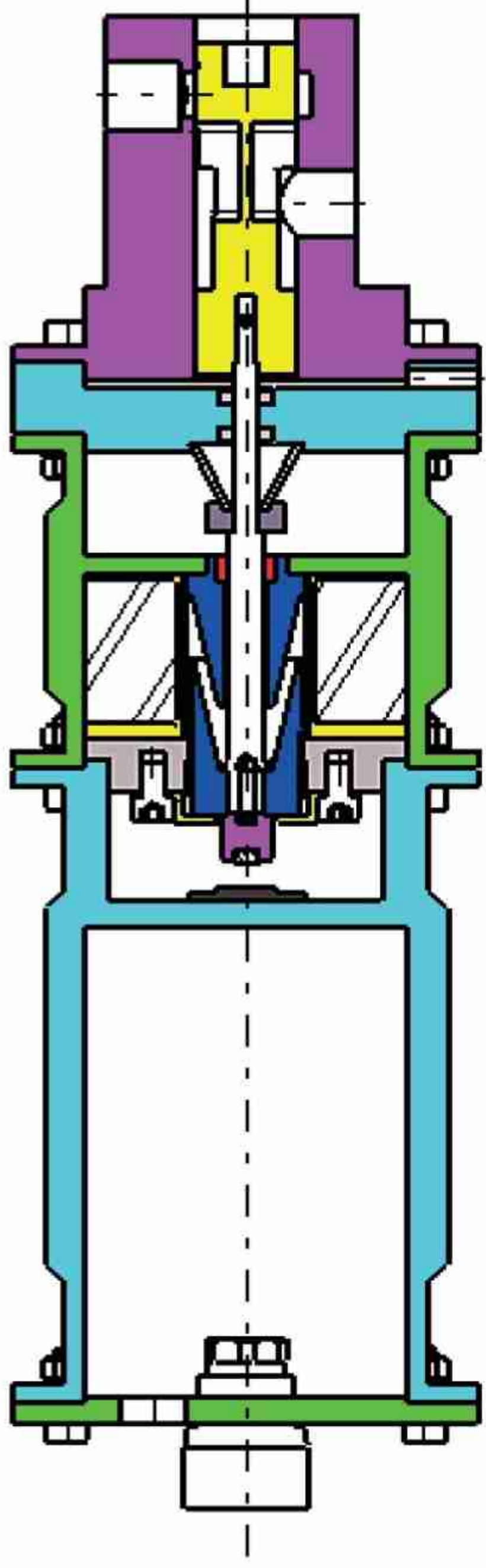
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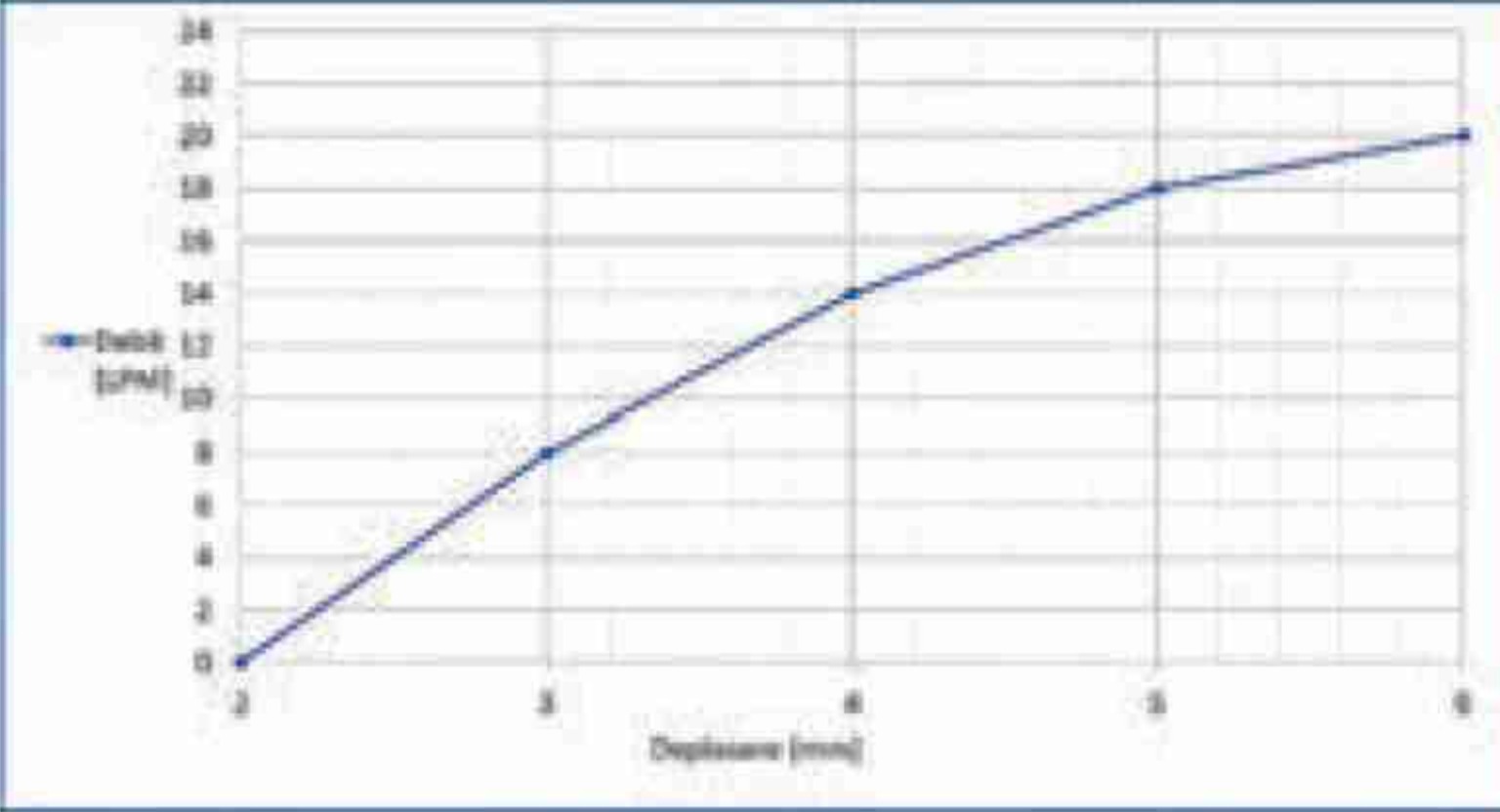
Proportional Solenoid Valve with Electronic Control

Patent application no. A/00476/29-08-2023

*Authors: PÎSLARU-DĂNESCU Lucian ¹, ZĂRNEȘCU George-Claudiu ¹,
CHIHAIA Rareș-Andrei ¹, POPA Marius ¹, POPESCU Ionel ², MIU Jan ²,
ILIESCU Cristian ², ANGHEL Tiberiu ²*
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² Institute for Theoretical and Experimental Analysis of Aeronautical - Astronautics Structures (STRAERO), Bucharest, Romania



Section through the proportional solenoid valve with electronic control



Flow characteristic as a function of piston displacement, at inlet pressure of 20 bar

Novelty/Description: The patent application consists of the realization of a proportional solenoid valve with electronic control. This is made up of:


- a linear proportional electromagnetic actuator assembly formed by a mobile core that moves linearly in the electromagnetic field generated by a coil;
- an electronic control module assembly that provides Pulse Width Modulation (PWM) type control voltages for powering the coil. The displacement of the moving component of the linear proportional electromagnetic actuator depends only on the ratio between the pulse duration and the PWM voltage period, i.e. the duty cycle, for a fixed frequency of the PWM control voltage, of 24 kHz, and the set peak-to-peak amplitude of the applied voltage of 24 V.
- a hydraulic assembly of the proportional solenoid valve with electronic control, which includes a piston that moves in the hydraulic cylinder under the influence of the electromagnetic force generated by the linear proportional electromagnetic actuator and the opposite elastic force from a spring. The overlapping of the piston channels with the circular channel of the cylinder creates two openings of variable section, the fluid flow rate increasing directly proportional to the displacement of the hydraulic assembly piston in the range of 2 - 6 mm, at 20 bar inlet pressure.

Advantages:

- Simple and robust design of the proportional solenoid valve with electronic control hydraulic assembly that performs flow control, so that the working fluid exerts only radial forces on the piston, ensuring a perfect balance of forces and eliminating opposition to the piston movement. In this way, the risk of wear is reduced and an increase in durability is achieved;
- The proportional solenoid valve with electronic control has a linear flow characteristic depending on the displacement of the hydraulic assembly piston;
- Fast response time of the proportional solenoid valve with electronic control, due to the movable magnetic core and the fixed magnetic core, of truncated conical shape, as well as the supply of the coil with voltage in the form of Pulse Width Modulation;
- The electronic control module is integrated into the construction of the proportional solenoid valve with electronic control.

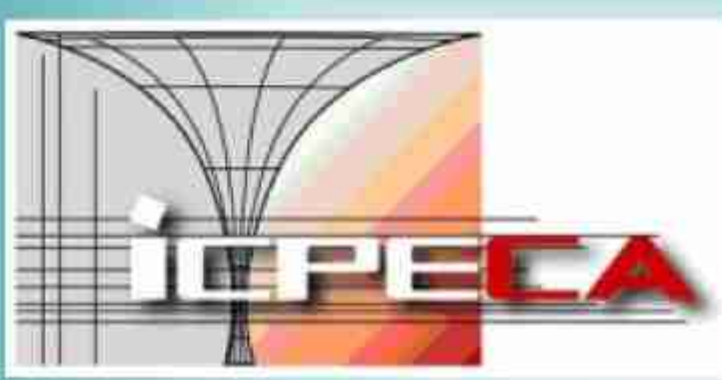
Applications in the fields of:

- in the aerospace industry, in flight control systems, as it can control the fluid in hydraulic systems that actuate control surfaces such as ailerons, flaps, spoilers, elevator, rudder and trim tabs;
- in the defense industry, as it can control the flow of fuel and oxidizer in rocket engines, which is essential for their guidance and control;
- for hydraulic systems that control rudders and other steering mechanisms on ships;
- in drinking water treatment plants, for precise control of chemicals and water flow in treatment processes.



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Code A. Mechanics-Engines-Machines



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Nanocomposites Based on Polyurethane Foam/Silver Nanoparticles and Process for Their Production

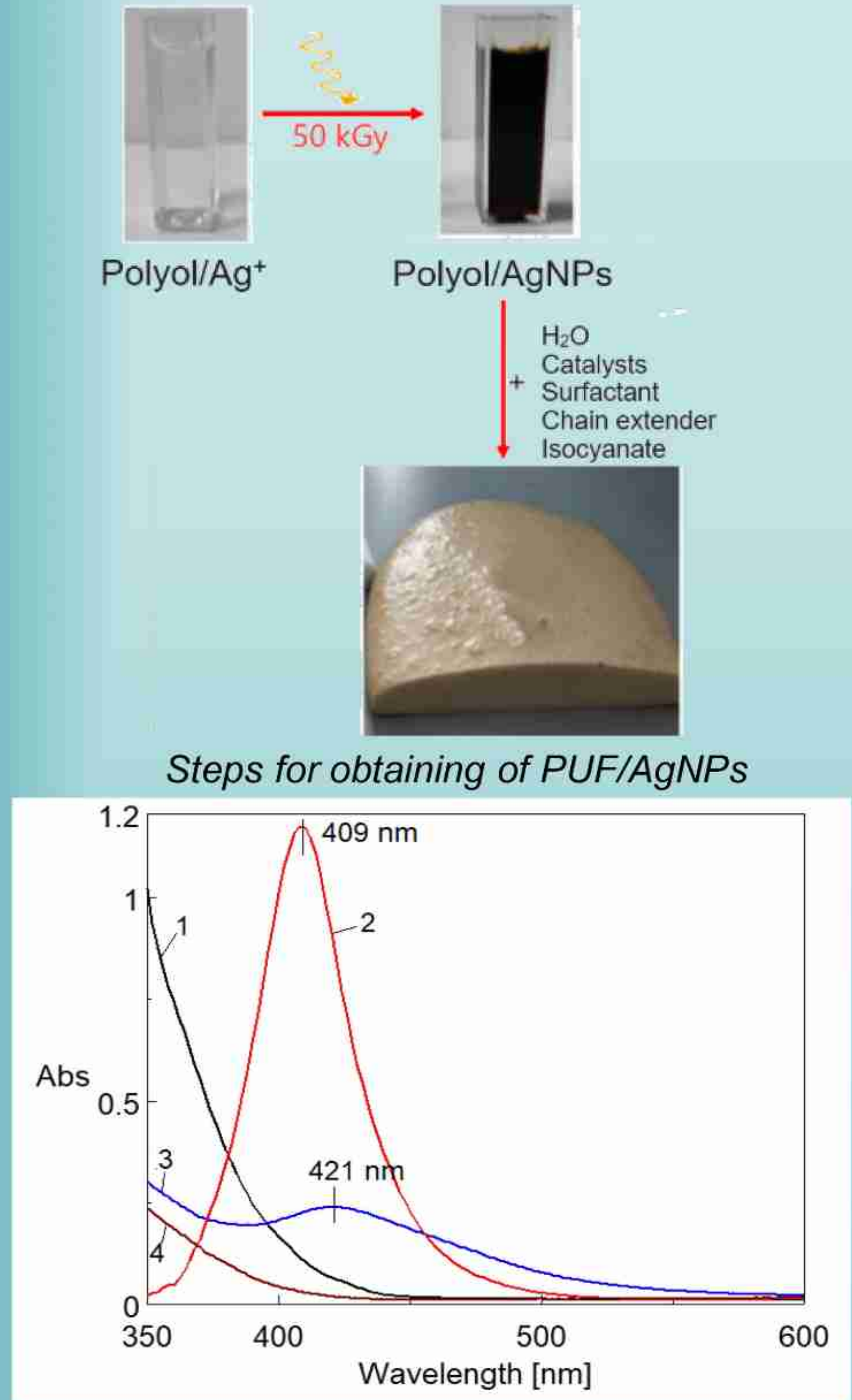
Patent Application No. A/00662/11.10.2022

Authors: Lungulescu¹ E.M., Nicula¹ N.O., Setnescu¹ R., Ion¹ I., Marinescu¹ V.E., Fierascu² R.C., Stan³ M.S.

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Novelty/ Description

The invention relates to nanocomposites based on polyurethane foam (PUF) and silver nanoparticles (AgNPs), synthesized in situ with controllable properties (size, narrow size distribution, and high stability) and antimicrobial activity, as well as to the process for their obtaining. According to the invention, polyurethane foam/silver nanoparticle nanocomposites are obtained by γ -radiation exposure of a polyether polyol solution which contains a small amount of water (less than 1.0%), in which a silver ion precursor is dissolved. It may also contain stabilizing agents for the polyol matrix and enhancers for the silver nanoparticle reduction process, such as natural or synthetic antioxidants. Due to its specific chemical structure, the polyether solution exhibits intrinsic resistance to ionizing radiation, ensuring the stabilization of silver nanoparticles.



Advantages:

- ❖ The proposed method for obtaining polyurethane foam/silver nanoparticle nanocomposites is simple and fast, can be carried out at ambient pressure and temperature, and requires only a single step.
- ❖ The synthesis of polyurethane foam-based nanocomposites involves mixing the irradiated polyol solution/silver nanoparticles with modified isocyanates of the prepolymer type (containing 18-30% NCO), in the presence of blowing agents, catalysts, and surfactants. Irradiating the polyol solution, with a small amount of water containing the silver ion precursor, enables precise control of process parameters (concentration, temperature, dose) at any point in the reactor, ensuring high reproducibility.
- ❖ The synthesis process does not require toxic or biologically hazardous reducing agents; the primary reducing agent in the absence of oxygen is the hydrated electron, which has a very high reduction potential.
- ❖ The resulting nanocomposites exhibit uniform dispersion and high long-term stability of silver nanoparticles.
- ❖ The proposed synthesis process allows for the cost-effective production of large quantities of polyurethane foam/silver nanoparticle nanocomposites with controlled size and structure, making it suitable for industrial-scale applications.
- ❖ The average nanoparticle size and size distribution critically depend on a limited number of easily controllable parameters, specifically the irradiation dose and the initial concentration of silver ions.

Applications:

The in-situ synthesis of silver nanoparticles within polyol presents an innovative approach for polyurethane foam nanocomposites, enabling direct nanoparticle integration without additional stabilizers. The results confirm that PUF/AgNPs are biocompatible, showing no cytotoxicity, membrane damage, or pro-inflammatory effects in HaCaT cells after short-term exposure. Additionally, the uniform nanoparticle distribution enhances mechanical strength and antimicrobial properties, making these nanocomposites promising for biomedical applications, such as hospital bed mattresses, floor mats, and covering materials.



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Superhydrophobic Structures with Self-Cleaning Effect Based on SiO₂ Functionalized with HMDS-type Silane and Obtaining Process

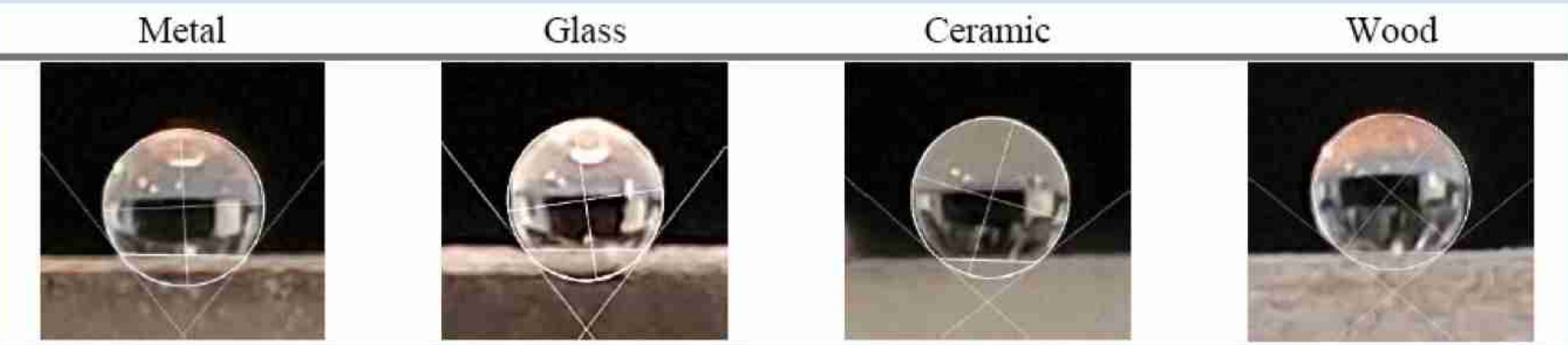
Patent Application No. A 00523/22.09.2023

Authors: M. M. Codescu¹, E. Chițanu¹, T. Mălăeru¹, C. A. Banciu¹, V. E. Marinescu¹, G. Georgescu¹, D. Pătroi¹, I. Borbáth², T. Borbáth², F. T. Boros², C. Bencze²

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Novelty / Description

The invention refers to materials with a self-cleaning effect, prepared starting from silica-polymer type materials, which present controllable properties of (super)hydrophobicity and self-cleaning capabilities (water contact angle: 135-167°, drop roll angle: 3-5° and self-cleaning effect, exhibited by entrainment of dirt by water), made by functionalizing the surface of SiO₂ nanoparticles (NPs) with hexamethyldisilazane (HMDS), prepared using the Stöber process, which allows the synthesis of SiO₂ particles with controllable, uniform sizes, and to the process of obtaining them. Materials with (super)hydrophobic behavior are found in applications in bio anti-fouling paints, transparent coatings for windshield glass, photovoltaic panels, solar cells, stain/water resistant clothing, anti-icing, anti-corrosion coatings.



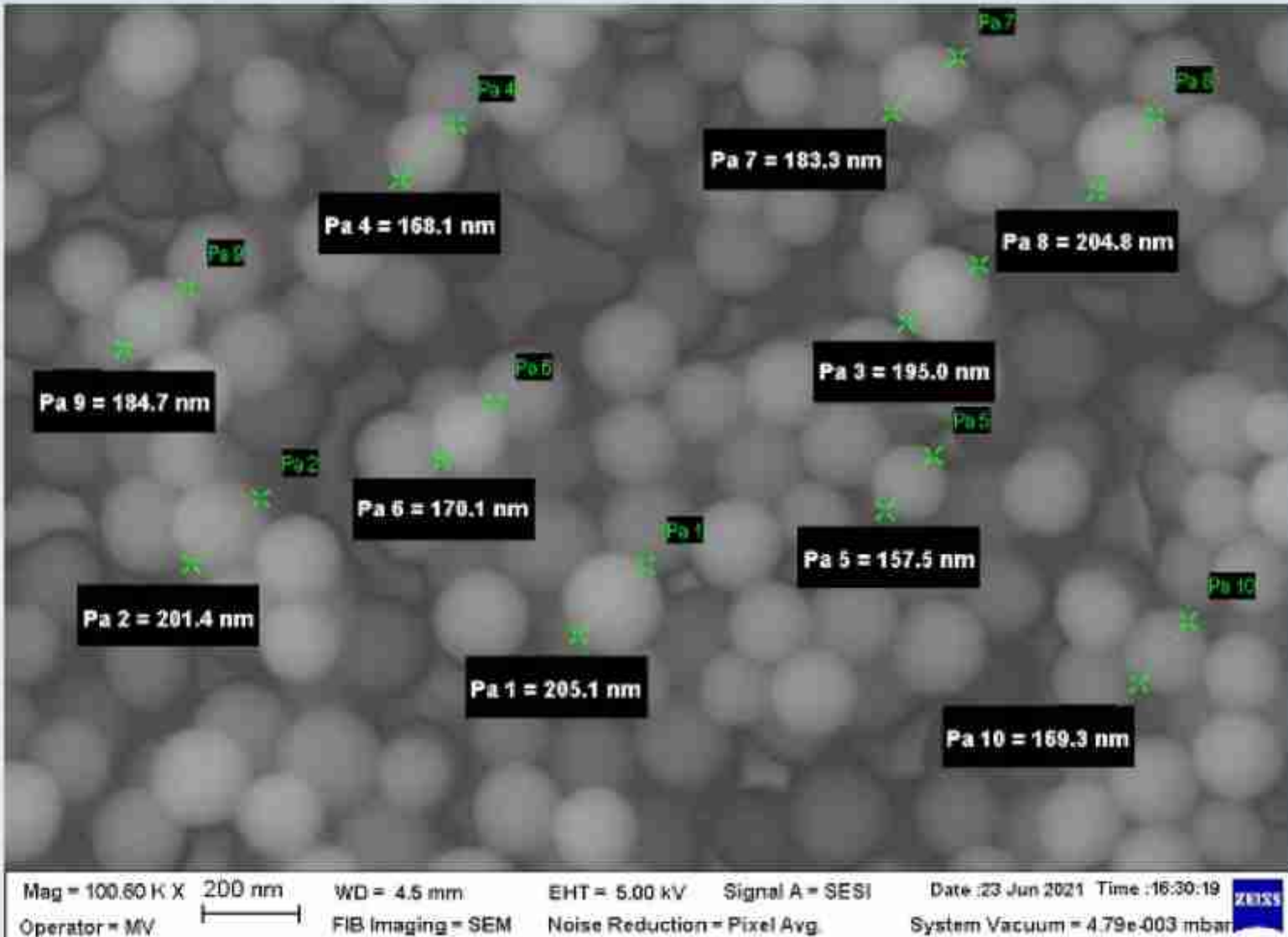
Contact angle measurements for various coatings based on SiO₂ NPs functionalized with silane

Metal: 130° - 143°

Glass: 136° - 141°

Ceramic: 143° - 150°

Wood: 142° - 143°



Advantages:

- ❖ chemical synthesis of nanopowders with high control of structural and functional properties;
- ❖ ensuring the hydrophobic properties by functionalizing with silanes;
- ❖ weak water adhesion and self-cleaning behavior;
- ❖ possibility of use in coatings for parts with special geometries.

Applications:

Superhydrophobic structures with self-cleaning effect based on SiO₂ functionalized with HMDS-type silane have applications in the fields of:

- ❖ bio anti-fouling paints;
- ❖ transparent coatings for windshield glass;
- ❖ photovoltaic panels, solar cells;
- ❖ stain/water resistant clothing;
- ❖ anti-icing;
- ❖ anti-corrosion coatings.

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