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Lysis Technologies Ltd.

Latest developments in the rotational moulding using the concept of nanotechnology for surface modifications: opportunities and case studies.

Lysis Technologies at Rotopol 29th and 30th of MAY 2025

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BCF
BRITISH COATINGS FEDERATION

BPF British Plastics Federation

Association of Rotational Moulding (Central Europe) e.V.

INTRODUCTION & HISTORY

Lysis Technologies Ltd.

One of the 100 most Innovative UK companies

Scientific team of engineers and material scientists

Research and development laboratory. Tailor-made products e.g. varnishes and paints.

Lysis /ˈlaɪsɪs/ly-səs; Greek λύσις lýsis, Modern meaning: SOLUTION (to a problem…)

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Lysis Technologies' division for the plastics moulding industry

TESOPLAS logo visualizes the transfer of a graphic to a surface.

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Building strong distribution network in China, India, Europe: Rising Sun, Phychem Technologies, Tesoplas Europe.

INTRODUCTION & HISTORY

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What we do:

- ***Label-free graphics: Post Mold/In Mold***
- ***Finishing products***
- ***Improvement Products***
- ***Repair Products***
- ***Functional and Decorative coatings***

INTRODUCTION & HISTORY

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Partners

Presentation OUTLINE

HOW WE CAN HELP YOU ADD EXTRA VALUE TO YOUR PRODUCT

- Nanocomposites integration
- Surface funcionalization materials
- Surface funcionalization methods
- Sustainable materials development
- Nanomaterials for Rotational moulded surfaces
- Case studies and applications

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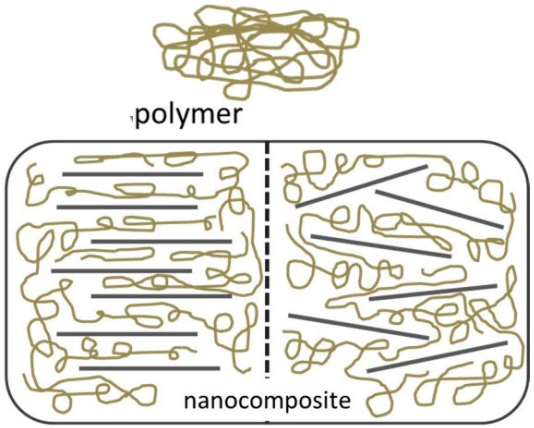
Nanotechnology in Rotational Moulding: Surface Modification Innovations

Nanocomposite Integration

Recent studies have explored the incorporation of nanoparticles, such as zinc oxide, nanoclay, and carbon nanofibers, into polymer matrices used in rotational moulding.
Combining the properties of inorganic and polymeric materials.



Different types of composites arising from the interaction of layered nanocomposite

Benefits:

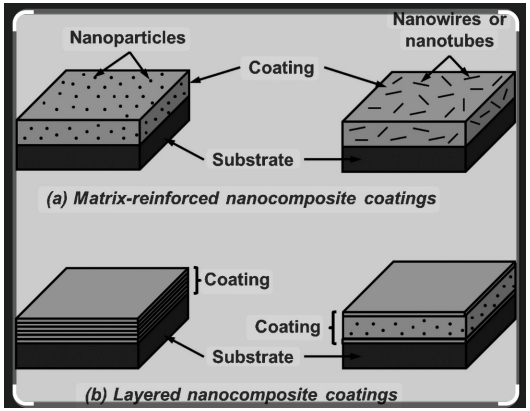
- mechanical properties Improvements (increased tensile strength & modulus)
- Enhanced thermal stability
- Enhanced resistance to environmental degradation
- Overall weight reduction
- Increased Barrier Properties
- Increased hydrophobicity

Challenges:

Optimising nanoparticle's loading level (excessive amounts can adversely affect performance)
Homogeneous distribution, avoiding agglomeration in masterbatches.

Solution:

Film Creation on the outer surface that ensures the perfect creation of controlled outer layer
Or Encapsulated film with improved stability



Traditionally, when making a plastic, functional additives are added to the plastic granulates to give the overall plastic item a functionality such as antistatic or antimicrobial. When additives added, the overall product characteristics can be inferior as for example mechanical strength is reduced, or brittleness increased. The Lysis Technologies encapsulation technology allows that the outer plastic surface is only functional since that is only required. So, the overall characteristics of the part stay intact. This is very important for crosslinked polymers.

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Surface Functionalization Materials/Techniques

1. Antimicrobial Coatings:

Incorporating antimicrobial agents, such as silver nanoparticles, into surface coatings has proven effective in inhibiting bacterial growth. These coatings are particularly beneficial for products used in healthcare, food processing, and water storage, where microbial contamination is a concern.

• **Medical Devices**: Rotomoulded components with antimicrobial surfaces have been developed for use in medical settings, reducing the risk of infection and improving patient safety.

E.g. **LT Surface enhancer with Antibacterial properties**.

Silver Nanoparticles (AgNPs)

• **Function:** Antimicrobial surface protection.
• **Application:** Used in medical devices, water tanks, or food-contact surfaces.
• **How it works:** Disrupt microbial cell membranes on contact, preventing growth

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2. **Superhydrophobic Surfaces**:

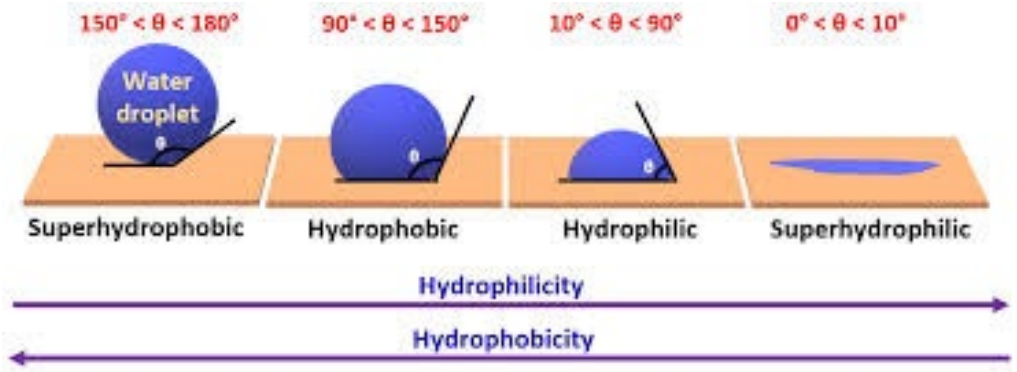
Replicating micro- and nano-scale structures inspired by natural surfaces
e.g. lotus leaves,
Achieved water-repellent properties on polymer surfaces.
These surfaces:

- resist water
- exhibit self-cleaning capabilities,
- suitable for applications where hygiene and maintenance are critical, baby changing units, buoys, tanks

Case Studies and Applications

• **Water Storage Solutions**: Tanks and containers featuring superhydrophobic inner surfaces have been designed to minimize biofilm formation and facilitate easier cleaning, ensuring safer water storage.

- **Buoys**: Hydrophobicity self-cleaning surface



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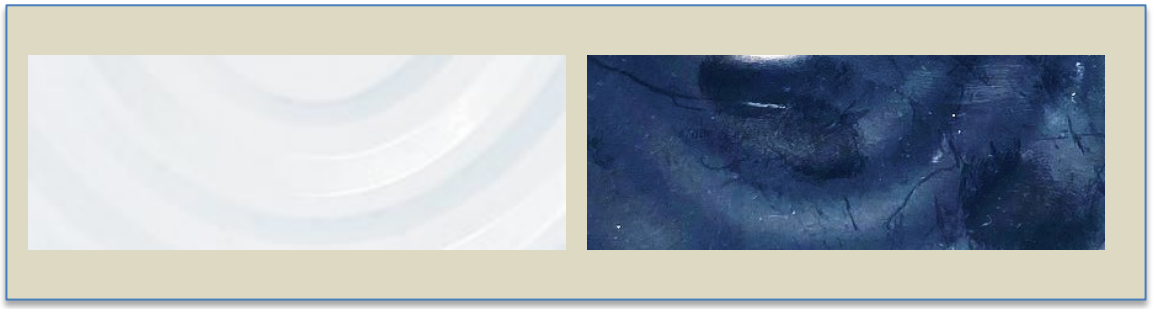
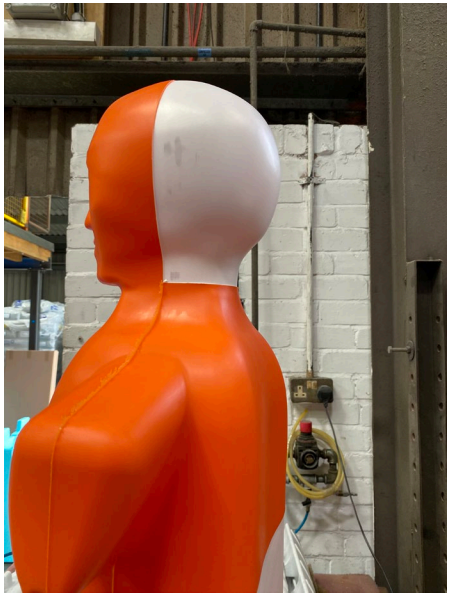
3. Zinc Oxide (ZnO) ***Whiter than white!!***

- **Function:** UV protection, heat stability, self-cleaning, and antimicrobial properties.
- **Application:** Outdoor furniture, playground equipment, tanks exposed to sunlight.
- **How it works:** Absorb UV radiation; photocatalytic effect breaks down organic contaminants and microbes.

TiO2 is used Commonly in white pigments. Reducing particle size, means increasing surface areas, opacity is improved





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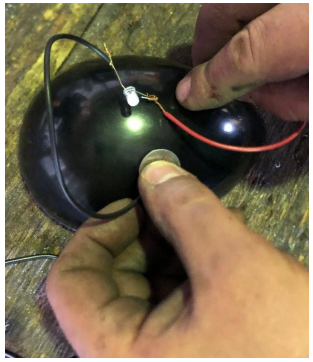
4. Carbon Nanotubes (CNTs) & Graphene

- **Function:** Improve electrical conductivity, mechanical strength, and thermal stability.
- **Application:** Electronics housings, antistatic containers, or parts needing EMI shielding.
- **How it works:** CNTs form conductive networks in the polymer, enabling static dissipation or charge conduction.

In Mold coating using Crosslinked PE “Superlink”

Conductive:
10^3 ohm/cm^2



LAMP TEST: POSITIVE

Coloured Conductive

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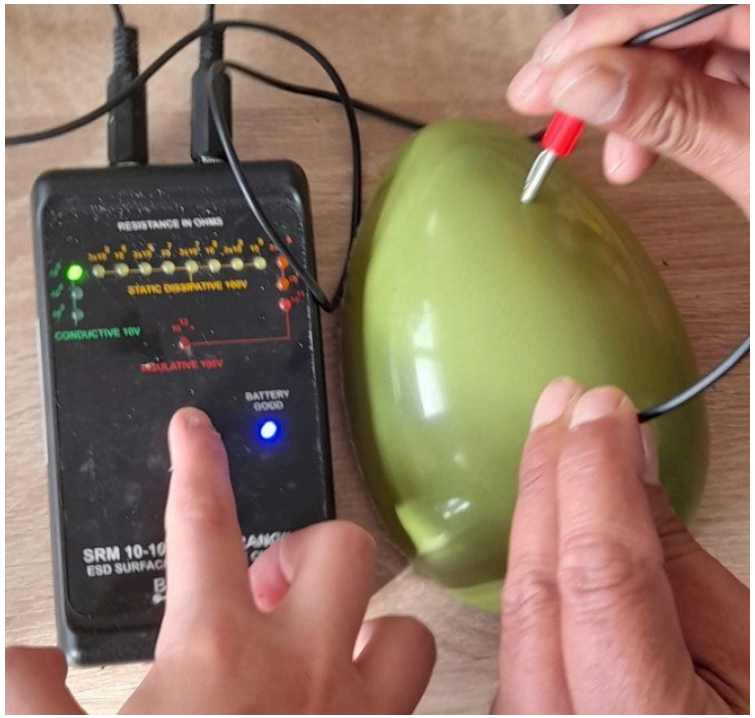
Coloured Coatings: Conductive or Antistatic

Cross-linked PE:
Superlink

Conductive:
10^5 ohm/cm^2



Colour: olive

Antistatic:
3x10^7 ohm/cm^2

Colour: Bright Yellow

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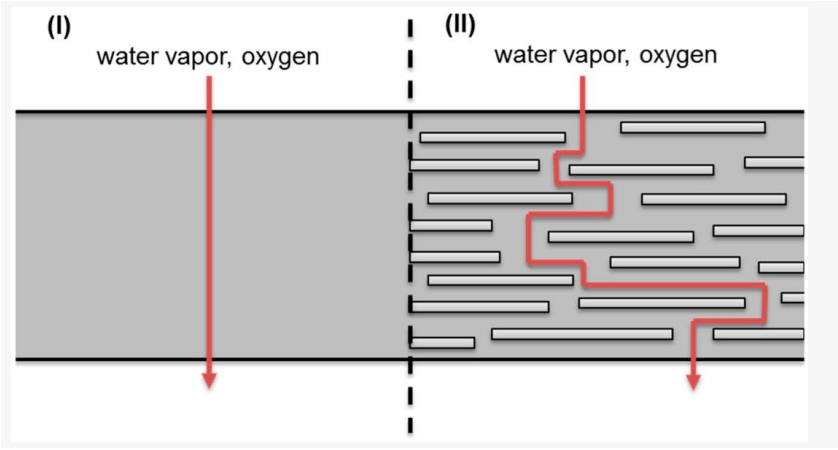
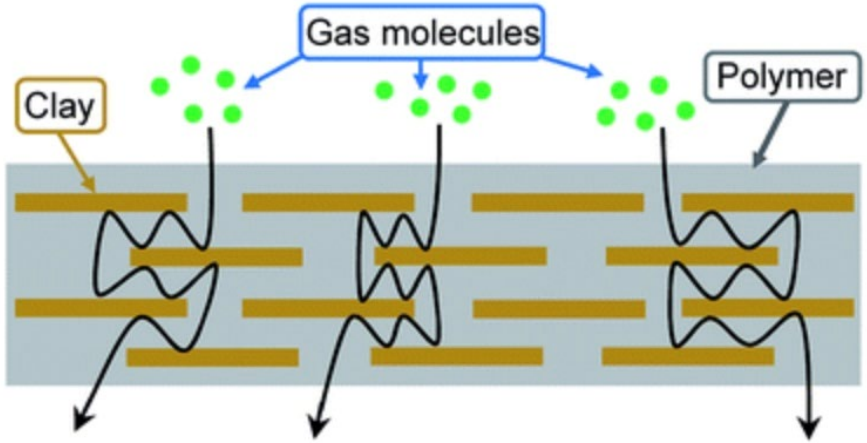
5. Barrier properties

Nanoclays

- **Function:** Improve barrier properties (against gases, moisture), mechanical strength, and thermal stability.
- **Application:** Ideal for packaging, fuel tanks, and containers where reduced permeability and improved structural integrity are needed.
- **How it works:** Platelet-like structure aligns in polymer matrix, creating a tortuous path for gas molecules.

Project: Fuel Tanks for Motorcycles





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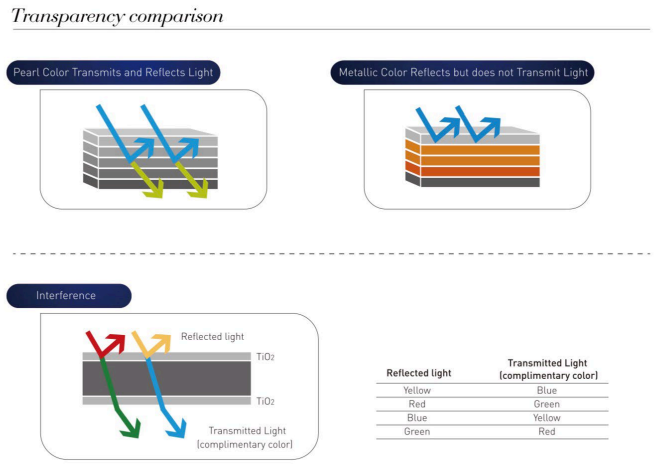
6. Interference Pigments

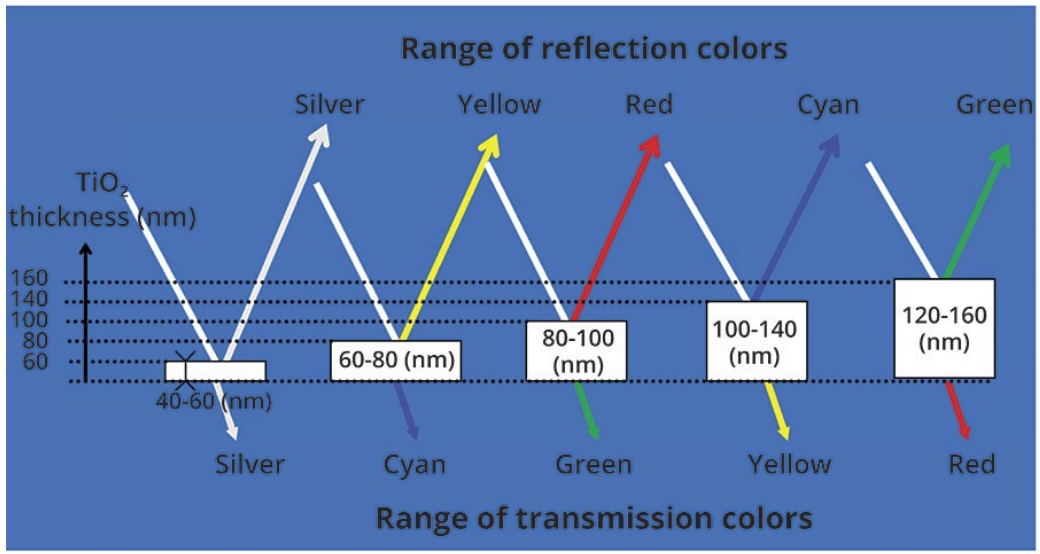
1. Interference pigments: thin, transparent layers with alternating refractive indices.
When light interacts with the layers, multiple reflections occur, leading to interference patterns.
Colour is result of constructive and destructive interference of reflected light waves, depending on the thickness of the layers and the wavelength of light.

2. Nanoscale Interference Pigments:
Pigments at nanoscale (typically > 100 nm) enhance the interference effects due to the increased surface area and potential for more precise control over layer thicknesses and refractive indices.
This allows for finer colour control and visual effects, making them more vibrant and dynamic.

3. Applications in Rotomoulding and Polyethylene:
Interference pigments can be incorporated into polyethylene via various methods, including masterbatch production, melt blending, solution blending. *At Lysis it is successfully used in permanent coatings as this way enhances the effects.*
Wide range of applications, decoration in furniture, outdoor indoor, automotive, where special effects like iridescent colours, shimmering textures, or unique light-scattering properties are desired.

4. Types of Special Effects:
Iridescence: The most common effect, where colours shift as the viewing angle changes.
Lustre: Enhancing the surface sheen and brilliance of the polyethylene.
Brilliance: Increasing the overall optical clarity and visual appeal.





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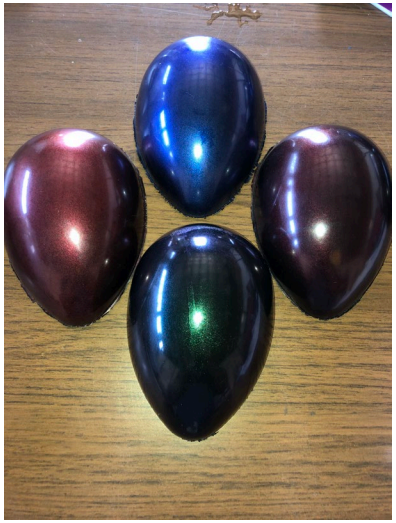
Interference Pigments



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6. PTFE Nanoparticles

1. Enhanced Surface Properties
Low Friction: PTFE has one of the lowest friction coefficients among solids.
Hydrophobicity: It repels water, providing excellent **moisture resistance**.
Non-stick Surface: Prevents fouling or buildup on the coated PE surface.

2. Improved Barrier Properties
Reduces **gas and vapor permeability**, enhancing shelf life in packaging applications.
Acts as a **protective layer** against chemicals and environmental degradation.

3. Thermal and UV Stability
PTFE remains stable across a wide temperature range.
Resistant to UV degradation, making the coating durable for outdoor and industrial use.

4. Chemical Resistance
Inert to almost all chemicals—ideal for **harsh environments** or chemical packaging.

- **Function:** Superhydrophobicity and scratch resistance.
- **Application:** Used in self-cleaning surfaces or high-wear environments.
- **How it works:** Creates rough micro/nano surface texture and reduces surface energy, causing water to bead and roll off.

Surface Functionalization Methods

- **In-situ incorporation**: Nanomaterials are mixed directly into the polymer powder before moulding.
- **Surface coatings**: After or before moulding, a coating with embedded nanomaterials is applied to provide targeted surface properties.
- **Hybrid strategies**: Combine functional nanoparticles with printable inks or binders (e.g., through pad or screen printing).

Challenges and Considerations

- **Dispersion**: Uniform nanoparticle distribution is critical—clumping can weaken performance.
- **Health & Safety**: Some nanoparticles (e.g., CNTs, AgNPs) require careful handling due to potential toxicity.
- **Cost vs. Benefit**: Nanomaterials can be costly, so their use is typically reserved for high-performance or high-value parts.

Opportunities

- **Smart Rotomoulded Surfaces**: Sensors, conductive tracks, or responsive coatings integrated into the surface.
- **Sustainable Additives**: Bio-based nanofillers like nanocellulose offer green alternatives with excellent reinforcement properties.
- **Advanced Applications**: Aerospace and defence, automotive parts that demand lightweight, high-strength, multifunctional surfaces.

Permanent graphics & coatings

In-mold

- Applying the integrated methods described above

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Permanent graphics & coatings

Post-mold

kprotomolding

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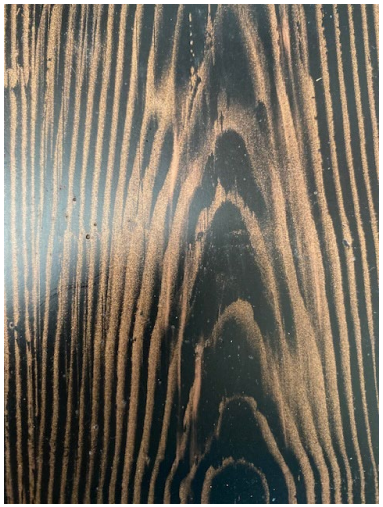
Permanent graphics & coatings

In-mold (spray) coating



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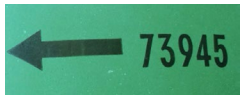
Permanent graphics & coatings

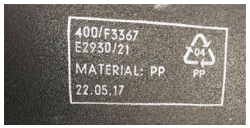
On-mold coating

- *Decoration: of e.g.* ***flower pots, ornaments, containers etc.***

Permanent marking & identification

Stamping method





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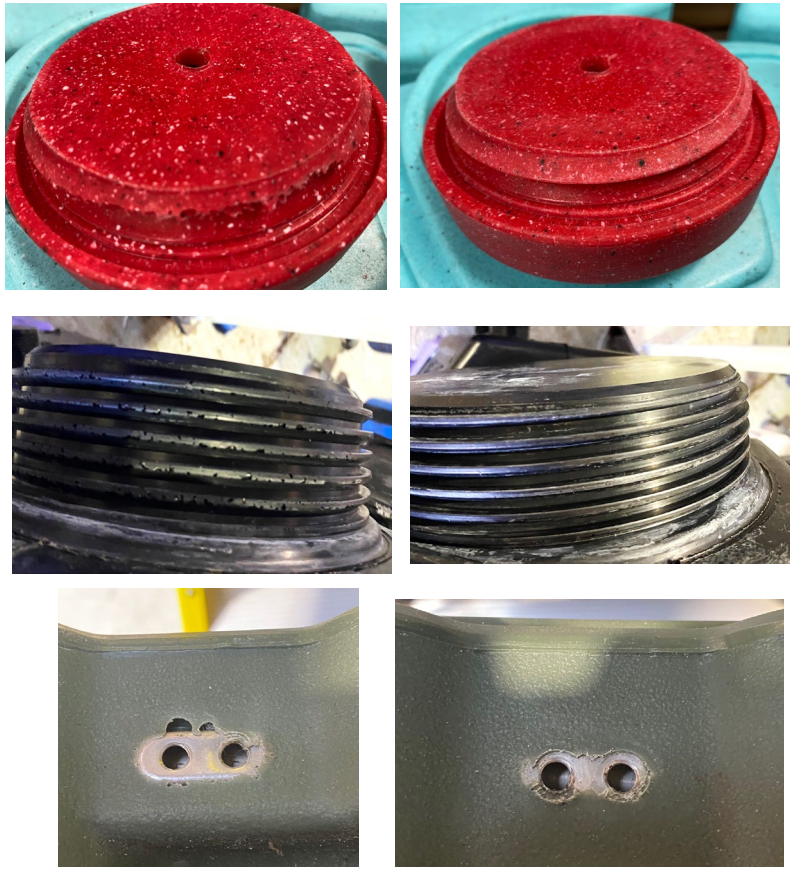
Enhancing Products:
Product savings and waste reduction

Maybe a "healthier" choice…

PERFECTION SPRAY
-3in1-

- Elimination of Pinholes
- Completion of threads
- Increased wall thickness
- Excellent value for money
- Improved part appearance and gloss
- Better Mold Release
- One of the safest in the market

SHORT LEAD TIMES - NO CUSTOMS - SUPPLY FROM THE EU OR UK – INDIA,PHYCHEM TECHNOLOGIES



w/o Perfection Spray

With Perfection Spray

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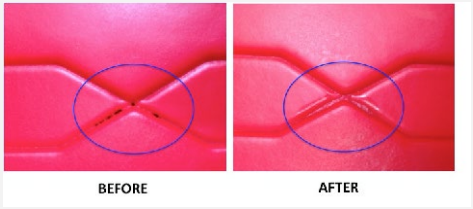
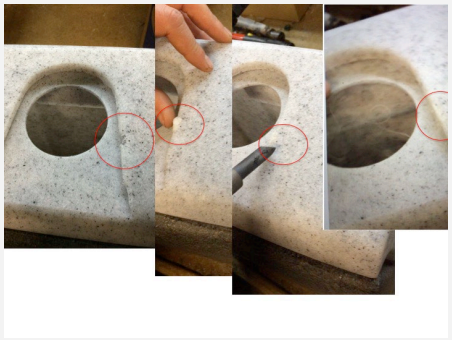
Enhancing Products:

Perfection Paste (IN Mold)

- Application into the Mould before Rotation
- Weak areas can be improved
- Various Colours available
- Improved Inserts
- Improved Letterings
- Paste Consistency for Ease of Application

with) w/o)





Enhancing Products:

Repair Paste (Post Mould)

- Paste Consistency for easy application
- Cosmetic Masking of poorly molded Parts or Blowholes
- For Curing, use an external Heat source, such as Soldering iron or Heat Gun.
- Standard and Customised Colours
- Application Videos on you-tube channel of Lysis Technologies

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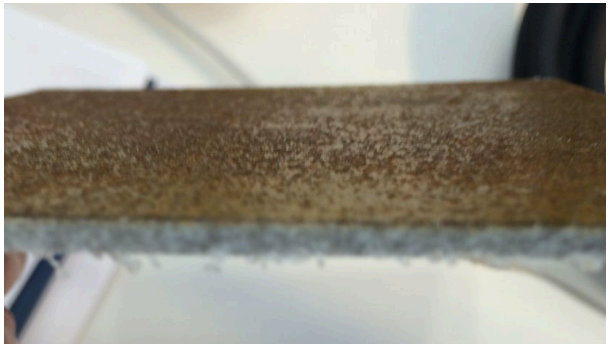
Functional Coatings (In & Post Mould)

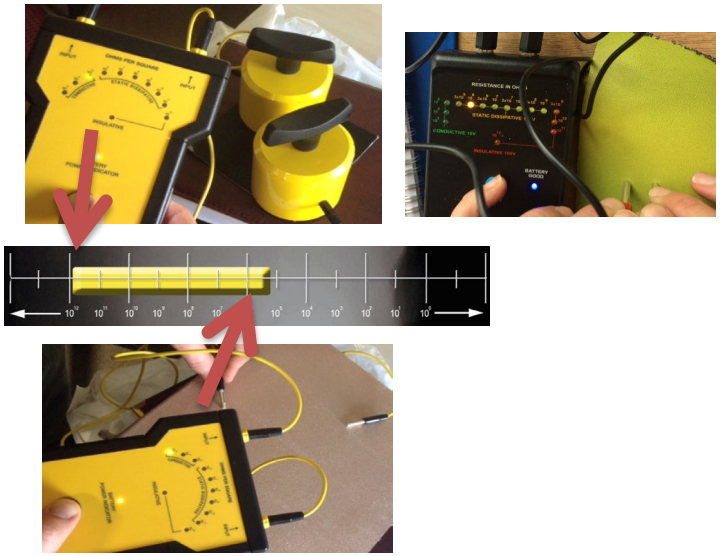
- Antimicrobial
- Antistatic – in Colours !!!
- Flame resist (UL94 Flame Tests for PP/PE)
- Anti-Slip
- Combinations of above

Antimicrobial

Anti-Slip



Antistatic or conductive in Colour!



Flame resist

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Applications

Marine
Leisure (e.g. camp)
Garden
Farming
Street furniture
Automotive….
……

Thank you very much

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EU- PRESENCE

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