

Method for producing colored abrasive paste

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CORE TECHNOLOGY: THE SMART ABRASIVE MEDIUM

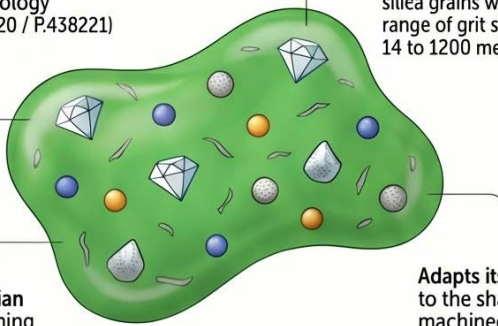
SMART COLOR-CHANGING ABRASIVE PASTE

Combines mechanical cutting power with advanced rheology (Patent P.438220 / P.438221)

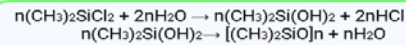
Customizable Abrasive Grit: Utilizes diamond & silica grains with a wide range of grit sizes from 14 to 1200 mesh.

Non-Newtonian Shear-Thickening Fluid

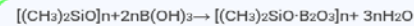
Adapts its viscosity to the shape of the machined part under pressure



Polysiloxane synthesis



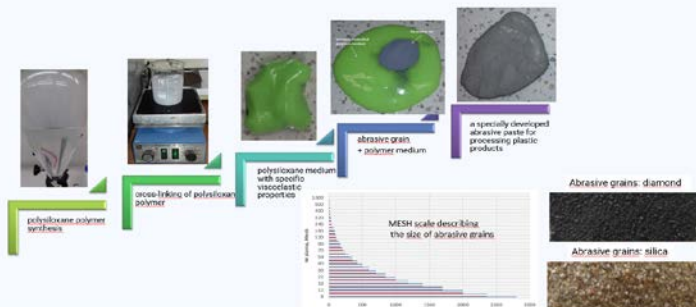
Crosslinking of polydimethylsiloxane (50°C, 4% mass. boric acid.)



Introduction of abrasive grains (diamond, silica) (5 - 60 %mass.)

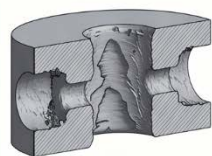
The developed solutions, described as a method for producing an abrasive paste medium and an abrasive paste, as well as a method for producing a colored abrasive paste

A proprietary method for producing abrasive paste



Advanced Abrasive Finishing for 3D Printed Internal Channels

INTRODUCTION & THE PROBLEM



The Challenge of 3D Printed Internal Channels

Additive manufacturing creates complex internal geometries for gas/fluid flow that require precise deburring and edge rounding in areas inaccessible to traditional tools.

Post-Processing Necessity

Internal surfaces require additional finishing to ensure optimal flow parameters and structural integrity.

INNOVATION: SMART COLOR-CHANGING ABRASIVE PASTE



Phase 1: Fresh Material (Bright Green)

The paste exhibits peak abrasive power and optimal rheology, featuring intact color-coated spheres.



Phase 2: Mid-Cycle Processing (Muted Green/Grey)

Active micro-cutting occurs as the paste is cyclically extruded; color spheres begin breaking down due to mechanical friction.



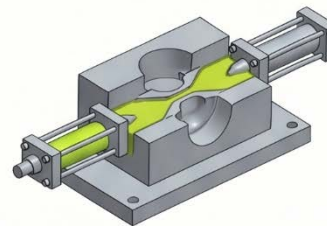
Phase 3: End of Life (Dark Grey/Black)

A clear visual cue indicates the abrasive is spent, triggering the need for regeneration or replacement without laboratory analysis.

Shear-Thickening Non-Newtonian Medium: A polysiloxane-based polymer (crosslinked at 50°C with 4% boric acid) that adapts its viscosity based on applied pressure.

METHODOLOGY:

ABRASIVE FLOW MACHINING (AFM)

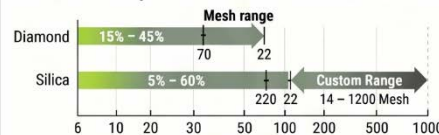


Two-Way Estrusion Process: The "tool" (polymer paste) is pressed through the internal channel in a flow direction, removing excess material and rounding edges.

Custom Pneumatic Testing Rig

Experimental validation was conducted at pressures of 0.250–0.750 MPa for 5–15 cycles at a frequency of 4–10 cycles/min.

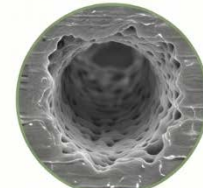
Abrasive Grain Specifications: MESH Scale Range (8 to 1000)



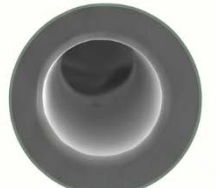
RESULTS & SURFACE QUALITY

Precision in Hard-to-Reach Areas

The flexible polymer "tool" adapts to any shape, achieving high quality even with minimal machining allowances.



Visual Evidence: Before (Rough Surface)



Visual Evidence: After (Smooth Surface)

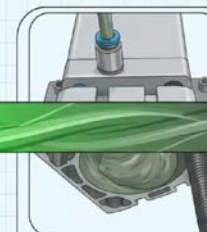
CONCLUSION

- Industrial Impact:** This patented solution (P.438220 / P.438221) increases process efficiency, reduces costs, and simplifies quality control through its information-carrying color function.
- Proven Stability:** The resulting paste exhibits chemical resistance and stable physical properties (viscosity and density) across production batches.
- Technology Readiness Level 5:** The technology has been validated in a relevant environment, moving toward industrial implementation.



1. Fresh Material

Peak abrasive power and optimal rheology. (Bright Green)



2. Mid-Cycle Processing

Active micro-cutting; color spheres begin breaking down. (Muted Green/Grey)



3. End of Life

Visual cue triggers immediate operator action. Requires regeneration or replacement. (Dark Grey/Black)

