A Process to Chemically Modify Polymeric Materials (#7445)

A process that chemically modifies polymeric materials through static, low-pressure infiltration.

Inventors at Georgia Tech have advanced a process called Vapor Phase Infiltration (VPI) that requires only a single exposure cycle to convert microns of polymer into a hybrid material. VPI can chemically modify a variety of polymeric materials in a variety of form factors using low-pressure, highly reactive gases. This technology utilizes the following steps: sorption, diffusion, and entrapment. During sorption, a gaseous metalorganic precursor is dissolved into a polymer. The precursor then migrates during the diffusion step. In entrapment, the precursor is immobilized through reaction or steric hindrance.

Benefits/Advantages

- **Cost reduction** – cost is reduced due to technique simplification
- **Efficiency** – technique has no requirement for repeated cycling
- **Flexibility** – VPI can be applied at any stage in production processes
- **Increased reliability** – chemical properties are more stabilized

Potential Commercial Applications

Manufacturing for:

- Polymer Membranes
- Polymer Fabrics / Textiles
- Polymer Films
- Polymer Foams
- Bulk Polymers
- Polymer Powders / Microspheres

Background/Context for This Invention

Atomic Layer Deposition (ALD) is a surface-controlled process that results in the deposition of thin films one layer at a time. Each atomic layer that is formed by this sequential process is a result of saturated surface-controlled reactions. In ALD, increasing processing volume presents significant challenges to the fluid dynamics in the chamber, with unpredictable effects on the quality of the film deposition. Additionally, long cycle times and the layer-by-layer nature of ALD result in slow deposition rates. There is a need to develop a more efficient process to modify polymeric materials.

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More Information

U.S. Patent Issued - 10364491

Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/process-chemically-modify-polymeric-materials

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot