GVD

Simple. Functional. Radical.

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Objectives

- To produce ultra-thin polymer coatings, including:
  - PTFE fluoropolymer
  - Silicones
  - Electrically-conductive polymers
  - Hydrogels
- To sell commercial coating services and equipment for producing these coatings.

The demands placed on modern materials are enormous. In large measure, surface properties determine the efficiency, compatibility, and durability of manufactured devices. GVD's mission is to meet the growing needs for ultra-thin coatings (10 nanometers – 10 microns) in a wide variety of industries at vastly different production scales. We have grown a diverse and experienced team capable of achieving success for our customers. Our expert R&D team includes chemists, process engineers, and manufacturing professionals.

Overview

Technology

- Solvent-free deposition of thin polymer coatings via initiated chemical vapor deposition

Coatings

- PTFE fluoropolymer, silicones, electrically-conductive polymers, hydrogels

Commercial Successes

- PTFE fluoropolymer coatings
  - Major rubber manufacturer (PTFE for mold release)
  - Major semiconductor equipment manufacturer (PTFE for lubrication)
- License Agreements/Development Programs

SBIR Experience

- Phase I/II SBIR work with Navy, Air Force, DARPA, Army, NSF, and NIH

History

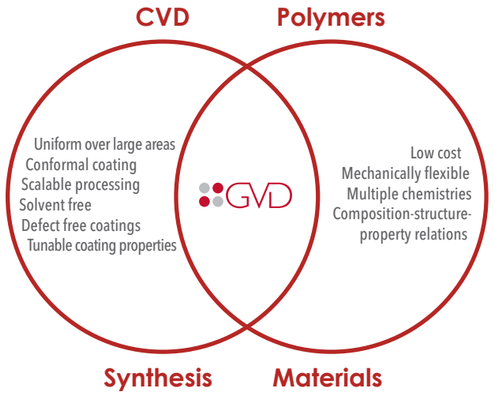
- Founded in 2001 as a spin-out from MIT

Locations

- Cambridge, MA (R&D Headquarters)
- Greenville, SC (Manufacturing)

Technology

GVD Corporation delivers ultra-thin coatings of high performance polymers. We provide coating services, R&D, and equipment to commercial customers. Our novel, solvent-free, low-temperature manufacturing process produces chemically pure polymer coatings which conform to very small surface features. A summary of features follows:



- Coating thickness typically in the range of 10 nanometers to 10 microns.
- Coatings are produced without solvents, primers, or drying/curing steps.
- Coatings conform to features down to the nanoscale.
- Coated parts remain at room temperature during coating (process accommodates fragile materials like plastics, paper, and fabrics)
- Inspired by processes used in the microelectronics industry
  - Unprecedented degree of control over coating properties
  - Provides precision surfaces and greatly improved products.
- Reproducible and scalable polymer coatings for semiconductor, aerospace, electronics, defense, medical, and consumer applications.
- Coatings dramatically improve product performance and throughput
- Process enables new products not achievable with conventional coating techniques.

Collaborative Model: Close collaboration with our customers is vital, whether we are employing our existing turnkey technology or developing custom solutions. Our expert R&D team of chemists, process engineers, and manufacturing professionals is uniquely suited to tackling your coating challenges and delivering custom polymer coating solutions. Customers come to us to address complex application-specific challenges, helping them to meet their product and market objectives. GVD works closely with its customers to provide coating services and to customize coatings for their specific applications. GVD-customer interactions often proceed along the following path:

- **Evaluation Phase:** We identify our customers' specific needs and perform coating trials for feasibility and performance testing. Often, two or three coating trial iterations are undertaken to optimize the coating formulation and deposition process.
- **Prototype Production:** We coat larger numbers of prototype parts that can be evaluated in real-world environments.
- **Low Volume Manufacturing:** We provide low volume manufacturing and prototyping solutions for our customers in multiple industries from our Cambridge, MA location.
- **Higher Volume Manufacturing:** We work closely with our customers to transition the optimized solution into higher volume production. We can provide coatings services in Cambridge, MA or Greenville, SC. Alternatively, we work with customers to provide technology transfer and licensing to allow manufacturing at their location.

Coating Services

GVD's strategic focus is the sale of coating services for demanding applications. PTFE (polytetrafluoroethylene) is GVD's flagship product, available in three standard formulations. These pure fluoropolymer products each exhibit the unparalleled properties of bulk PTFE in a thin, dry coating, including:

- Excellent non-stick/release performance
- Unsurpassed lubricity
- Chemical inertness
- Low dielectric constant
- Hydrophobicity
- Biocompatibility

GVD's PTFE coating products include:

- **PTFE-D:** Environmental protection coatings for electronics, including RF circuitry
- **PTFE-MR:** Lubricious (slippery) coatings for molding applications
  - Facilitates release of molded rubber and foam parts from their GVD-coated molds (PTFE-MR accommodates thousands of cure cycles without the need to recoat)
- **PTFE-E:** Lubricious (slippery) coatings for surface treatment of elastomers
  - Non-stick coatings for seals and gaskets

Other applications of GVD's PTFE products include:

- Biocompatible passivation for implantable medical devices
- Elimination of stiction in MEMS and microfluidic devices
- Surface modification for separation filters

GVD sells siloxane coatings under the **Exilis** tradename. These crosslinked coatings exhibit properties similar to those of GVD's PTFE products. **Exilis-D** coatings also offer outstanding adhesion and electrical resistance. For example, **Exilis-D** coatings have been immersed in salt water for nearly 8 years (under sweeping voltage) without degradation. This immersion test is on-going. **Exilis-D** coatings have the following applications (among others):

- Environmental protection coating for electronics, including RF circuitry
- Electrical insulation for neuroprosthetic devices (e.g., cochlear implants)

Other coatings in development at GVD include:

- Electrically-conductive (intrinsically-conductive) polymer coatings
  - Coatings for electromagnetic interference (EMI) shielding and resistive heating
- Hydrophilic polymer coatings
  - Biocompatible surfaces for medical devices

Markets

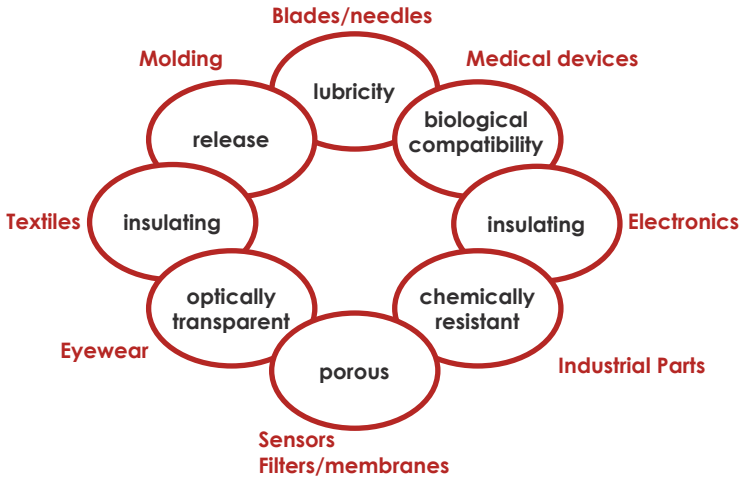
GVD's vision is to sell CVD polymer coatings to both traditional and non-traditional users of CVD (e.g., makers of consumer products and medical devices). Traditional CVD users (e.g., semiconductor manufacturers) typically have no experience with polymers; non-traditional users (e.g., consumer products manufacturers and medical device manufacturers) know polymers but usually have little experience with CVD.

GVD makes CVD polymers accessible to these customers by combining the functionality of polymer coatings with the gentleness of the process. **For instance, a key enabler is the ability to coat parts that are incompatible with standard wet coating processes,** such as:

- Plastics
- Rubbers
- Tooling with tiny features

In these cases, traditional wet coating methods would either damage the part irreparably, create undesirable thermal distortions (e.g., due to high-temperature drying/curing), or obscure fine features critical to performance.

GVD has successfully launched commercial applications where its PTFE-MR and PTFE-E coatings have proven to be enabling. GVD's applications are in markets that include medical devices, semiconductors, electronics, military, and consumer products. The graphic below illustrates the diversity enabled by the unique properties of the PTFE coating.



Value proposition

GVD has commercialized a proprietary technology for coating objects with well-known but difficult-to-process polymers. Such polymers include non-stick PTFE (polytetrafluoroethylene), siloxanes, and others in development. Our dry coating technology is superior to traditional wet, high-temperature coating methods. GVD offers novel, solvent-free, low temperature, conformal coatings that boast an unprecedented combination of thinness, purity, and performance.

Profile

Dr. Karen Gleason, Founder.
Dr. Gleason (MIT professor, Department of Chemical Engineering) is a world-renowned expert in chemical vapor deposition and the author of more than 200 publications in the field. Dr. Gleason's innovative research forms the cornerstone of the rapidly expanding new field of CVD polymers.

Dr. Hilton G. Pryce Lewis, Co-Founder.
Dr. Lewis is the driving force behind the commercialization of Dr. Gleason's technology. GVD has "cracked the code" of commercializing CVD polymer coatings. By carefully selecting just a few key enabling materials and developing the markets for them, GVD has managed to create a viable commercial technology with a rapidly growing market presence and brand.

Together, Drs. Gleason and Pryce Lewis represent a formidable force for the successful development and commercialization of new polymer coating products. Dr. Gleason provides unprecedented R&D capabilities for the development of new coatings and technologies; GVD provides the skills necessary to turn these into successful commercial products. This combination has generated a perfect pipeline for commercialization.