

Nikolai Semenov

Polymer Engineer | R&D, Process & Technology Ownership

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[LinkedIn](#) | [Google Scholar](#) | Languages: English (Professional Working Proficiency), Russian (Native)

Summary

Polymer Engineer specializing in taking difficult, highly filled, and processing-sensitive polymer systems from lab formulation to stable industrial production — proven across distinct material classes, from elastomers and silicones to biobased composites. 18+ years developing polymer materials for compounding, extrusion and injection molding applications, with a consistent record of stabilizing narrow process windows for moisture-sensitive, highly filled, and otherwise unstable formulations that standard processing struggles with. PhD-level background in polymer rheology enables deep root-cause analysis of complex processing defects and formulation failures.

Track record spans rubber and elastomeric composites, silicone insulator formulations, fiber-reinforced and damping materials, and biobased/fiber-filled packaging systems — played key technical roles in 6+ joint industrial–academic R&D programs through to technology transfer, and delivering 6+ biobased formulations from concept to pilot customer validation with measurable shelf-life extension in food-contact applications. Authored SOPs, validation protocols, and production-ready technical documentation, and advised client facilities on process start-up and stabilization. Practiced EU food-contact regulatory compliance (EU Reg. 10/2011, 1935/2004) in pilot customer documentation.

Pragmatic and hands-on, I am actively targeting Senior Individual Contributor (IC) or R&D Manager roles. My priority is solving complex processing challenges, driving lab-to-production scale-up, and delivering immediate technical value, rather than pursuing administrative management titles.

Core Competencies

- Polymer formulation and compounding; twin-screw compounding, extrusion, injection molding, thermoforming
- Process window stabilization and scale-up of moisture-sensitive and processing-sensitive systems
- Filled polymer systems, elastomers, and composite materials — formulation and reinforcement for target mechanical and processing performance
- Biobased, biodegradable and functional polymer systems (TPS, PBS, PBAT, PLA, fiber-filled blends) for packaging applications
- Lab-to-production technology transfer; tooling optimization, defect-rate reduction, first-article qualification
- Material characterization for process and quality control (rheology, DSC, DMA, mechanical testing, microscopy, spectroscopy)
- Supporting food-contact compliance activities (EU Reg. 10/2011, 1935/2004), migration testing, material specification
- Design of Experiments (DoE), root-cause analysis, process troubleshooting, technical documentation
- SOP authoring, validation protocols, supplier and raw-material qualification, QC procedures
- Project and technology ownership — leading formulation programs from concept through industrial scale-up

Experience

Bpacks Lab — Head of R&D

Belgrade, Serbia | Jul 2023 — May 2026

Applied R&D — biobased and fiber-filled polymer composites for food-contact packaging

Owned applied R&D and product development for biobased and fiber-filled polymer composites destined for rigid food-contact packaging (trays, cups, lids), covering materials characterization of moisture-sensitive biopolymer systems through

formulation, pilot validation, and industrial scale-up. Designed experimental programs combining laboratory work with pilot-line trials and prepared regulatory-facing technical documentation for pilot customers.

- Built the R&D function from inception — set up the laboratory (equipment specification, supplier qualification, method validation) and recruited and led a 4-person team (2 PhDs, 2 engineers).
- Developed and optimized 6+ biobased and fiber-filled polymer formulations for rigid food-contact packaging (trays, cups, lids), advancing each from concept to pilot customer validation within 12 months.
- Extended fresh berry shelf life by 7 days and mushroom shelf life by 4 days through targeted material selection and barrier packaging optimization, directly enabling customer retail commercialization.
- Scaled 2+ formulations from laboratory compounding to pilot- and industrial-scale extrusion and injection molding; resolved tooling and processing bottlenecks, reducing time-to-production.
- Coordinated R&D delivery with pilot customers, suppliers, and production teams to translate market needs into technical specifications
- Stabilized processing of moisture-sensitive biopolymer systems across 3 industrial scale-up runs, eliminating production stoppages and achieving consistent melt quality batch-to-batch.
- Prepared material specifications, validation protocols, and production-oriented technical documentation for pilot customers in compliance with EU Regulation 10/2011 and 1935/2004.
- Optimized tooling parameters and processing windows, cutting defect rates and enabling reliable output across extrusion and injection-molding platforms.
- Examined structure–property relationships of moisture-sensitive polymer systems, with findings feeding directly into formulation decisions.
- Performed manufacturability pre-screening of part geometry using Altair Inspire Mold (draft angle analysis, venting layout, air trap prediction) to validate formulation-process compatibility before issuing tooling specifications to mold designers

Institute of Applied Mechanics — Senior Researcher (Polymer Materials Science)

Moscow, Russia | Jan 2008 – Mar 2023

15-year engineering career across formulation development, composite reinforcement, and industrial technology transfer

Progression: Lab Assistant (2008) → Junior Researcher (2009) → Researcher (2013) → Senior Researcher (2018),

Owned formulation and process development for filled polymer systems, elastomers, and composite materials over a 15-year tenure, contributed to 6+ joint industrial–academic R&D programs from concept through technology transfer for commercial clients. Built and ran experimental programs to diagnose processing issues, optimize filler–matrix interactions, and translate material behavior into robust, production-ready formulations. Supervised technical staff and mentored junior engineers through project delivery.

- **Smart Materials Engineering:** Developed field-responsive (electro- and magnetorheological) elastomer and suspension formulations for a semi-active vibration-control device program; supervised the experimental team and coordinated cross-group collaboration through to working prototypes. Optimized curing formulations for structural adhesives and industrial coatings to eliminate processing defects.
- **Rubber & Composite Formulation:** Developed reinforced rubber and elastomeric composite formulations, including surface activation and modification of natural and mineral fillers to meet target mechanical properties. Designed and implemented an organosilane-based surface-modification process for mineral fillers, including in-situ modification during milling, as lead engineer on a materials-development project.
- **Process & Quality Diagnostics:** Used AFM and interferometric surface analysis to troubleshoot filler–matrix interactions in highly filled systems and resolve quality issues; applied the same diagnostic toolkit to root-cause analysis of impact-damaged materials on a project investigating failure mechanisms of protective screens.
- **Industrial Silicone & Composite Engineering:** Directed development and scale-up of silicone insulator formulations, authoring full SOPs for production; formulated fiber-reinforced polymers and specialized elastomeric damping materials operating across a –50 °C to +30 °C range, including development of torsion dampers for overhead ultra-high-voltage power lines, with documentation prepared for industrial implementation.

- **Biomedical Materials Engineering:** Engineered core-shell magnetically responsive sorbent materials for selective target extraction and developed analytical workflows for bio-fluid processing and fractionation.
- **Early-Career Materials Development:** Developed and tested low-filled elastomer formulations containing carbon nanotubes and conducted probe-microscopy-based quality assessment of reinforcement performance in hyperelastic composites with low nanofiller content.
- **Technical Leadership:** Supervised 6 MSc students and mentored junior researchers through applied project completion in polymer materials development; authored 15+ technical/peer-reviewed publications documenting formulation and process work (see Publications below).

BEREŽKA — Director of Innovation & Co-Founder (part-time, ~20% FTE)

Moscow, Russia | Jun 2020 – Mar 2023

Sustainable packaging startup — fully plant-based biodegradable composites

- Co-founded the venture and directed applied R&D for a sustainable packaging startup, conducting research on fully biobased polymer composites for disposable, injection-molded materials including cups and tableware.
- Studied degradation behavior and environmental stability of plant-based polymer systems, including testing under saline-water exposure and real-use conditions, bridging experimental research with pilot-scale material validation.
- Delivered an MVP validated in pilot manufacturing, positioning the company for commercial launch.
- Formulated and optimized materials across 2+ processing platforms (injection molding, compounding), achieving consistent part quality at pilot scale.
- Performed mold filling simulation using SolidWorks Plastics (flow analysis, weld line prediction, air trap identification) to validate material processability and generate technical specifications for mold designers.

Independent Consulting (self-employed) — Technology Consultant — Polymer Processing (remote, ~5% FTE)

Worldwide | Feb 2018 – Dec 2021

- Advised 5+ SME clients on polymer compounding, extrusion, and injection-molding start-up and stabilization, diagnosing formulation and processing errors that were causing costly production instability.
- Launched and stabilized one industrial compounding line from equipment commissioning through first-article qualification.
- Developed 10+ custom polymer formulations (wood-plastic composites, recycled PVC, elastomers, silicones) tailored to specific processing constraints, reducing variability during early production runs.
- Implemented quality control procedures and raw-material qualification workflows, establishing repeatable production standards across multiple client facilities.

Technical Skills

- **Characterization:** Rheology (rotational, dynamic), DSC, DMA, mechanical testing (ISO/ASTM), OTR/WVTR, microscopy (AFM, SEM, optical), spectroscopy (FTIR, Raman), interferometry
- **Processing & Scale-up:** Twin-screw compounding, extrusion, injection molding, thermoforming, lab-to-production transfer, process window stabilization, tooling optimization, industrial trials
- **Quality & Compliance:** Food-contact materials (FCM), EU Regulation 10/2011 & 1935/2004, PPWR, migration testing, QC procedures, supplier qualification, material specifications
- **Methodology:** Design of Experiments (DoE, R scripting, ANOVA, FFD, BBD), root-cause analysis, process troubleshooting, technical documentation, industrial trials management
- **Software:** OriginPro, Excel (advanced), Autodesk Fusion 360 (tooling design), basic mold flow analysis using SolidWorks Plastics and Altair Inspire Mold (mold flow simulation, weld line prediction, air trap analysis, manufacturability pre-screening, wrapping, venting, fill, etc.), MATLAB & COMSOL (basic)

Education

PhD (Candidate of Science) — Mechanics of Fluid, Gas and Plasma (focus: Rheology)

Institute of Applied Mechanics, Russian Academy of Sciences | Moscow, Russia | Sep 2009 – Aug 2013

Dissertation: “Rheology and Mechanics of Electrically Controlled Polyimide-Based Nanosuspensions”

Engineer Degree (MSc equivalent) & Bachelor — Material Science and Technology of New Materials

Moscow State Academy of Fine Chemical Technology | Moscow, Russia | Sep 2003 – Feb 2009

Graduating work: “Study of Reinforcing Activity of Nanofillers of Different Nature According to the Data of Physical-Mechanical and Dynamic Tests”

Publications

15+ peer-reviewed papers in applied polymer physics and rheology, documenting formulation and process development work (2012–2023). Full list available via [Google Scholar](#) and [ResearchGate](#).

Additional Professional Activities

- Delivered applied training courses: “Rheology of Polymer Composites,” “Introduction to Polymer Materials Science,” and “Atomic Force Microscopy” (lectures and hands-on laboratory/practical sessions).
- Supervised and mentored 6 MSc students in materials science and engineering through applied project completion.
- Appointed Chair of the Graduation Examination Committee (MSc level) at a leading Russian technical university, 2022.
- Long-term (2010-2022) member of the Technical and Program Committee of The All-Russian Scientific Conference with International Participation: ‘Mechanics of Composite Materials and Structures, Complex and Heterogeneous Media’.

Industry Features & Media

- “Rigid Packaging from Bark” — feature article, Bioplastics Magazine (2024).
- Expert commentary on sustainable material alternatives featured in Plastics Today and Packaging Tech Today.

Target Roles: Senior R&D Engineer, Principal Polymer Engineer, or Hands-on R&D Manager. Open to Senior Individual Contributor (IC) roles to focus on deep-tech formulation and immediate technical impact.