

CORROSION · YIELD STRENGTH · FATIGUE · IMPACT ENERGY · CARBURIZING  
MELTING · ROLLING CONTACT FATIGUE · ALUMINUM · HYDROGEN EMBRITTLEMENT  
NICKEL · FATIGUE · MATERIALS DESIGN · TITANIUM · NITRIDING · ULTIMATE  
STRENGTH · NANOSTRUCTURE · STEEL · ELECTROSLAG REMELTING · STRENGTH  
ALLOYS · YOUR DEMANDING APPLICATIONS · THERMODYNAMICS · CARBURIZING  
COATINGS · GEAR · TOUGHNESS · MATERIALS BY DESIGN · SLIDING WEAR · QUALITY  
ASSURANCE · AUSTENITE · HIGH TEMPERATURE · FAILURE ANALYSIS · TENSILE  
STRENGTH · STEEL · PASSIVATION · FERRITE · COMPUTATIONAL DESIGN · EROSION  
SUPERALLOYS · STAINLESS · EXTRUSION · POWDER METALLURGY · MECHANICAL  
BEHAVIOR · AEROSPACE · FORGING · BENDING FATIGUE · COMPOSITE  
MICROSTRUCTURE · **NEED HI-PERFORMANCE MATERIALS** · SOLUTION  
SOLIDIFICATION · PRECIPITATION · COMPUTATIONAL DESIGN · TENSILE STRENGTH  
COST ANALYSIS · METALLIC GLASS · PROTOTYPE · SEGREGATION · AEROSPACE  
GEAR · HOMOGENIZATION · STRESS CORROSION CRACKING · MACHINABILITY  
OPTIMIZATION · PERFORMANCE · QUANTUM MECHANICS · INTERMETALLICS  
TITANIUM · STRUCTURAL STEEL · SECONDARY HARDENING · NANOCARBIDE  
ALUMINUM · **WHEN OFF-THE-SHELF ALLOYS DON'T SUFFICE** · ROBUST DESIGN · TEST  
PROTOCOL · CRYOGENIC TREATMENT · HIGH RESOLUTION · ATOM PROBE  
TOMOGRAPHY · DESIGNER KNOWLEDGE BASE · ACCELERATED INSERTION · ROLLING  
CONTACT FATIGUE · MARTENSITE · EROSION · NANOSTRUCTURE · FATIGUE  
SUPERALLOYS · ELECTRON MICROSCOPY · STAINLESS · FORGING · GEAR  
SECONDARY HARDENING · PREDICTIVE DESIGN · PRECIPICALC · CORROSION  
CRACKING · ELECTROSLAG REMELTING · STRENGTH · HYDROGEN  
EMBRITTE · **QUESTEK** · INTERMETALLICS · FRACTURE TOUGHNESS  
SHAPE MEMORY ALLOYS · DEVITRIFICATION · STRUCTURAL STEEL · NICKEL  
FRACTURE TOUGHNESS · STRESS CORROSION · PASSIVATION · MATERIALS BY DESIGN  
FERRITE · ATOM PROBE TOMOGRAPHY · DESIGNER KNOWLEDGE BASE · AUSTENITE  
METALLURGY · FERRIUM · ACCELERATED INSERTION · QUALITY ASSURANCE · FAILURE  
STAINLESS STEEL · YIELD STRENGTH · **WE PROVIDE THE SOLUTION** · ANALYSIS  
TENSILE STRENGTH · CORROSION · HIGH TEMPERATURE · PRECIPITATION · IMPACT  
ENERGY · CARBURIZING · VACUUM MELTING · SOLIDIFICATION · FATIGUE · COST  
ANALYSIS · METALLIC GLASS · SEGREGATION · COATINGS · ULTIMATE STRENGTH

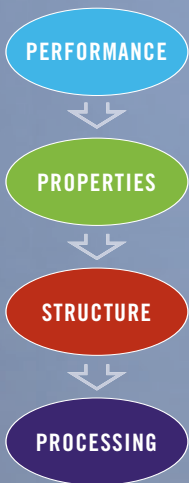
# MATERIALS AS SYSTEMS

Materials have paced the evolution of technology for millennia. Yet materials have remained largely mysterious because of their complexity. Take for example thermal processing, which at the millimeter scale affects the structure of materials, while simultaneously at the nanoscale creates particle dispersions that strengthen the material. The personality of each material depends on many physical interactions, and for this reason materials are approached as complex systems at QuesTek. We adapt a hierarchy of computational tools and instrumentation to understand and control the complex structures of materials.



# MATERIALS BY DESIGN® SOLUTION

There are four key elements in materials science: performance, properties, structure, and processing. At QuesTek, we begin the materials design process by combining the perspectives of users, suppliers, modelers, and



designers into a set of property objectives driven by performance requirements. Systems analysis is then applied to key structure-property and processing-structure relations. In contrast, historical materials development has been based on the discovery process of trial-and-error, which may require a multitude of prototypes, take a decade or more, and cost millions of dollars. At QuesTek, we efficiently zero in on both material composition and processing conditions thanks to computation-heavy design efforts. *Materials by Design®* lowers risk, saves money, and greatly accelerates implementation compared to traditional materials development.

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# WHO WE ARE

Born out of research at Northwestern University, QuesTek Innovations has pioneered the development of computational materials design under the direction of our Chief Science Officer Prof. Greg Olson. Dr. Charlie Kuehmann, a founder of QuesTek in 1996, serves as President & CEO of the Company and directed the development of our *Materials by Design* technology. The Technology group at QuesTek is composed of internationally renowned materials design engineers who are at the leading edge of high-fidelity materials design. Our business model is to design, develop, and license high value-added materials and unique processes. This also includes assisting in the qualification of material producers and/or intermediate processors.

## CASE STUDY LANDING GEAR STEEL

*Materials by Design* gets results. When the U.S. Air Force needed corrosion resistant landing gear steel to eliminate toxic cadmium coatings, they turned to QuesTek. With a thorough understanding of the performance criteria, QuesTek designed the alloy microstructure, nanostructure, and processing path needed to make this unique steel a reality.

In a few design iterations QuesTek had computationally designed *Ferrium*<sup>®</sup> S53, an alloy with the best combination of strength, toughness, and corrosion resistance the world had ever seen. QuesTek designed S53 from the ground up and has successfully scaled the alloy from small prototype heats to multi-ton ingots.

Development of an alternative coating was the obvious solution to the toxic coating problem, however, QuesTek's computational systems design of S53 provided the best solution for the Air Force and ultimately the environment.



**QuesTek**<sup>®</sup>  
INNOVATIONS LLC

## WHAT'S NEXT

QuesTek Innovations is focused on developing the world's most unique alloys for use in various applications on land, sea, air, and space. QuesTek is a materials solutions company; hence we succeed when and only when our materials succeed. We will do everything it takes to make your product a success: from assessment of current needs, to computational materials design, through scale-up of an optimal material, plus process qualification and quality assurance. QuesTek has the resources to solve your most daunting materials issues. We take pride in our past success and eagerly anticipate our next design challenge.

The hi-performance material you need for your demanding application begins with **QuesTek**





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