November 2008

Process Optimisation to Improve Surface Quality in Fine Polyester Braids

Executive Summary

This development programme focused on reducing surface defects in USP 5/0 braided polyester by addressing process-induced variability braid manufacture.

Elevated rejection rates caused by slubs and fibrillation were traced to inconsistent spin finish behaviour prior to braiding. Rather than modifying the braid construction or changing materials, the engineering solution introduced a controlled pre-conditioning step to stabilise filament surface condition before braid formation.

The intervention significantly improved surface uniformity, reduced process variability, and demonstrated how targeted upstream process control can enhance braid quality without altering product design.

The Challenge

Surface uniformity is critical in fine braided medical textiles, influencing not only cosmetic quality but also downstream processing, coating performance, device integration, and surgical handling.

During production of USP 5/0 polyester braid, increased rejection rates were observed due to slubs and fibrillation. Root cause investigation indicated that inconsistent accumulation and release of spin finish disrupted filament cohesion during braiding, producing visible surface irregularities.

Key engineering challenges included:

- Eliminating slubs caused by localised spin finish accumulation
- Reducing filament fibrillation during braid formation
- Managing machine-to-machine process variability
- Improving manufacturing yield without changing braid construction or material specification
- Developing a repeatable solution suitable for existing production equipment

Engineering Objectives

The programme aimed to:

- Improve surface uniformity in USP 5/0 polyester braid
- Reduce slub formation and fibrillation
- Improve production yield by reducing reject rates
- Stabilise filament behaviour before braiding
- Develop a repeatable upstream conditioning process
- Maintain existing braid architecture material specification

Development Approach

Root Cause Investigation

Engineering analysis identified inconsistent spin finish distribution as the primary contributor to surface defects.

Variations in finish accumulation and intermittent release altered filament interaction during braiding, reducing cohesion within the braid and producing localised surface defects.

Process Intervention

Rather than redesigning the braid, a controlled pre-conditioning step was introduced upstream of the braiding process.

Polyester singles were routed over a lip roller before entering the braiding machine.

The intervention was designed to:

- Remove or redistribute excess spin finish
- Improve filament-to-filament consistency
- Stabilise surface condition before interlacing
- Improve uniformity during braid formation

Material was discharged after processing to isolate the effectiveness of the intervention without introducing downstream process variables.

Validation & Performance Assessment

Performance of the modified process was evaluated through direct comparison with untreated material.

Assessment included:

- Visual inspection for slubs and fibrillation
- Surface uniformity assessment
- Braid consistency evaluation
- Handling performance during downstream processing
- Comparative assessment across multiple braiding machines

Validation confirmed improved surface quality and demonstrated that upstream process control could significantly reduce defect formation without altering braid construction.

Process Control & Repeatability

To ensure consistent implementation, the pre-conditioning process was standardised through control of critical operating parameters.

Key process controls included:

- Lip roller contact conditions
- Consistent yarn path and dwell time
- Controlled redistribution of spin finish
- Machine-specific optimisation for high-variability braiders
- Comparative assessment across multiple production platforms

Running the process on machines known to generate higher rejection rates demonstrated that the intervention reduced variability across production rather than improving only ideal operating conditions.

Engineering Outcome

The programme successfully demonstrated that targeted upstream process control could significantly improve the surface quality of fine braided polyester without changing materials, braid architecture, or production equipment.

Key engineering outcomes included:

- Reduced incidence of slubs and fibrillation
- Improved braid surface uniformity
- Increased manufacturing consistency across multiple braiding platforms
- Lower rejection rates and improved production yield
- A repeatable pre-conditioning process suitable for routine manufacture

The study demonstrated that understanding filament surface behaviour can be as important as braid architecture in achieving consistent medical textile quality.

Application Relevance

The engineering principles demonstrated in this programme are applicable wherever surface quality influences manufacturing performance or clinical handling.

Surgical Sutures & Closure Systems

Fine braided polyester sutures requiring consistent surface finish, predictable knot performance, and high cosmetic quality.

Cardiovascular Surgery

Braided polyester sutures used in vascular repair and graft fixation where smooth surface characteristics contribute to reliable handling.

Orthopaedics & Sports Medicine

Braided reinforcement structures requiring controlled abrasion behaviour and compatibility with fixation devices.

Minimally Invasive & Robotic Surgery

Fine braided components requiring smooth passage through delivery systems while minimising friction variability.

Advanced Implantable Textile Systems

Braided textile structures requiring consistent surface characteristics to support coating performance, integration into assemblies, and manufacturing reliability.

Key Takeaways

- Surface chemistry can significantly influence braided textile performance and manufacturing quality.
- Targeted upstream process conditioning can improve braid quality without altering materials or construction.
- Understanding filament interaction is essential to reducing process variability.
- Small process modifications can deliver substantial improvements in manufacturing yield.
- Engineering process control is a powerful tool for improving quality while preserving established product designs.

"By controlling filament surface behaviour before braiding, a simple upstream process modification significantly improved braid quality without changing the material or construction."

Contact Corza Medical today

corzamedical

2755 Canyon Boulevard, 1st Floor
Boulder, CO 80302