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Development of Customisable Coating Formulations and Controlled Add-On Levels for Braided Structures

Executive Summary

Coatings play a critical role in determining the performance of braided medical textile structures, influencing handling, lubricity, interaction characteristics, and manufacturing consistency.

This development programme focused on establishing a scalable coating platform capable of supporting multiple formulation combinations and controlled coating add-on levels while maintaining repeatable performance across braided geometries.

The objective was to create a flexible coating process that could accommodate different specification requirements without requiring complete process redesign.

Through controlled formulation management and application control, the programme demonstrated a repeatable manufacturing framework capable of delivering multiple coating targets from a single production platform.

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The Challenge

Applying coatings to braided structures becomes increasingly complex when both composition and coating quantity must be tightly controlled.

The challenge extended beyond applying a uniform finish and required independent control of formulation balance and coating uptake while preserving braid integrity.

Key engineering challenges included:

- Maintaining controlled ratios between coating components
- Achieving multiple coating add-on levels within defined ranges
- Supporting both low and high coverage specifications
- Preserving handling and flexibility characteristics
- Maintaining coating uniformity across braided geometries
- Establishing repeatable production conditions

The programme required a process capable of delivering specification flexibility without introducing unnecessary variability.

Engineering Objectives

The programme focused on:

- Establishing a flexible coating platform
- Enabling controlled multi-component formulations

- Supporting variable coating add-on levels
- Maintaining coating consistency across braided structures
- Preserving mechanical and handling performance
- Enabling scalable manufacturing capability

Development Approach

Coating Architecture Development

A coating platform was developed to enable controlled adjustment of both composition and coating quantity.

The approach focused on:

- Combining primary and secondary coating components in controlled ratios
- Managing coating add-on across defined specification ranges
- Achieving uniform distribution across complex braided surfaces
- Maintaining repeatable application behaviour

The resulting process created a single adaptable coating framework capable of supporting multiple product requirements.

Manufacturing Process

A controlled application process was implemented to support consistent uptake and repeatable formulation control.

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Key process elements included:

- Stable multi-component formulation management
- Precision dip/pass coating methods
- Control of line speed and dwell conditions
- Viscosity optimisation
- Controlled curing conditions

These variables were refined to maintain consistency across different coating targets.

Validation & Performance Assessment

- Validation focused on confirming coating consistency and specification control across multiple operating conditions.
- Assessment activities included:
 - Verification of coating add-on levels
 - Confirmation of specification range achievement
 - Evaluation of coating distribution consistency
 - Assessment of formulation balance
 - Mechanical and handling performance review

Testing demonstrated successful delivery across multiple target ranges without negative impact on structural behaviour.

Process Control & Repeatability

Repeatable coating performance was achieved through the establishment of defined process windows and controlled application parameters across formulation and coating add-on ranges.

Critical process controls included:

- Defined formulation ratios to maintain consistent coating composition
- Monitoring of bath stability throughout production runs
- Control of coating uptake through application parameters and process conditions
- Optimisation of line speed, dwell time, and viscosity to achieve target add-on levels
- Controlled curing conditions to support coating uniformity and performance consistency
- Verification of coating coverage across braided geometries

Repeat production trials confirmed stable coating behaviour across multiple operating conditions and demonstrated the ability to deliver coating specifications consistently without compromising braid integrity or handling characteristics.

These controls established a repeatable manufacturing framework capable of supporting scale-up while maintaining **specification compliance across varying coating requirements.**

Engineering Outcome

This programme demonstrated that coating performance can be engineered as a controllable product variable rather than treated as a fixed finishing step.

By establishing a flexible coating platform with controlled formulation management and precise add-on control, the development enabled multiple coating specifications to be delivered through a single scalable manufacturing process.

Key engineering outcomes included:

- Establishment of a customisable coating platform capable of supporting multiple formulation combinations
- Controlled delivery of low, nominal, and high coating add-on levels from a common process framework
- Consistent coating distribution across braided structures with complex geometries
- Preservation of handling characteristics and structural performance across specification ranges
- Reduced development complexity through elimination of major process reconfiguration
- Improved manufacturing flexibility while maintaining repeatability and process stability
- Creation of a scalable production route capable of supporting evolving product requirements

The programme demonstrated that surface engineering can be used to actively tune product behaviour, enabling coating composition and coverage to become functional design inputs that support differentiated device performance.

Application Relevance

Cardiovascular

Braided textile structures requiring controlled interaction characteristics and consistent surface performance.

Orthopaedics & Sports Medicine

Braided repair constructs requiring predictable handling and knot performance.

Soft Tissue Repair & General Surgery

Closure systems benefiting from improved passage and controlled interaction.

Surgical Sutures & Closure Systems

Applications where coating influences lubricity, knot run-down, and consistency.

Minimally Invasive & Robotic Surgery

Braided delivery and navigation structures requiring controlled surface behaviour.

Advanced Implants & Tissue Technologies

Implantable textile systems where coating contributes to functional performance.

Key Takeaways

- Coating performance depends on both formulation and application control.
- Coating add-on can be used to tune product behaviour.
- Flexible coating platforms reduce development complexity.
- Repeatable process windows improve manufacturing consistency.
- Surface engineering can become a functional design tool.

“By confirming both formulation and coating level, surface performance became an engineered variable rather than a fixed finish.”



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