

# Spin Finish Analyzer

● the minispec



## Introduction

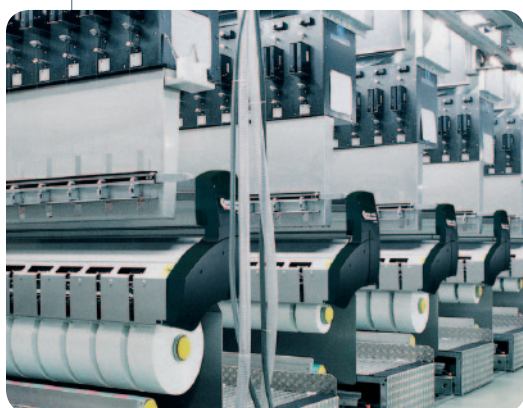
Spin Finish is added to the fiber during production in order to improve downstream handling of the fiber in the process of making textiles and all sorts of industrial products. Static electricity is avoided, sufficient lubrication is guaranteed, and cohesion of filaments is improved. Properly coated fiber travels more smoothly through the textile machines, allowing faster operation. Nonwoven fabrics produced without weaving also benefit from finish to improve handling and functional properties. Therefore it is evident that the amount of Spin Finish or finish on fabric is critical for efficient operation and has to be controlled as often and as quickly as possible. The minispec has proven to be the right solution for this type of problem, as the analysis completes within a minute and is therefore much faster than any classical wet chemical approach.

# • mq<sub>one</sub> Spin Finish Analyzer



## Fiber Industry then ...

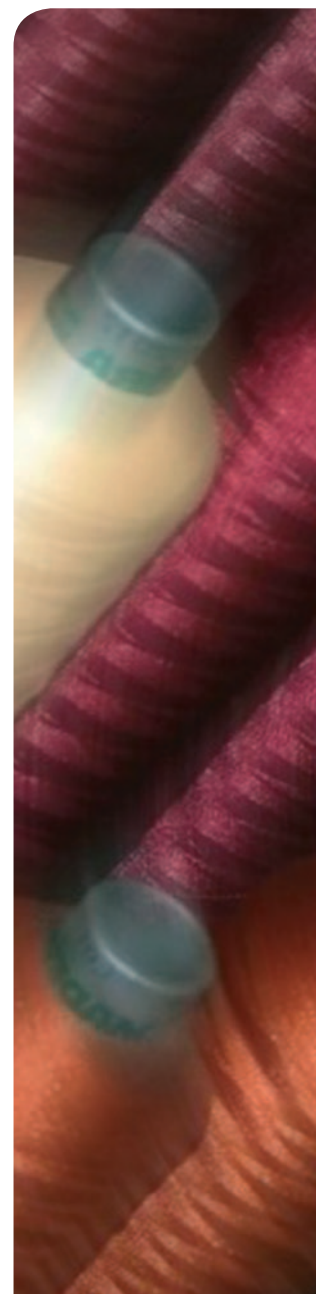
Decades ago, when fiber products were mainly processed within the same textile mill or factory, analytical testing was still in the fledgling stages if available at all. Over the years, as the industry grew and trade increased, mechanical tests and wet chemical analytical tests were introduced. The determination of the Spin Finish content on fiber materials quickly gained importance as a wet chemical extraction method. The testing was slow (at least a couple of hours), operator-dependent, destructive, and hazardous because it required extraction solvents.



## Fiber Industry now ...

Skip forward to the 2000's, when globalization and competitive pressure have forced companies to improve efficiency in all aspects of their operation, including better analytical methods.

It's no longer acceptable to wait many hours for Spin Finish results. Off-spec levels determined too late could mean rejected product or reduction in the value of what should have been a high-value product. Therefore Spin Finish determination nowadays is based on modern analytical technology, featuring fast, accurate, non-destructive and solvent-free analysis. Operation has to be user-friendly and the measurement should be performed by plant operators close to the production line. Today, Spin Finish determination, also known as Oil Pick Up (OPU or Finish on Fiber (FOF), or Finish on Yarn (FOY), can be determined within a minute, using the Bruker minispec Spin Finish analyzer.



# • Methods & Procedure

## Principles of NMR Method

The TD-NMR signal of a fiber sample exhibits different components, each characterized by a typical decay behaviour. Whereas the fiber shows a very rapid signal decay, moisture on the fiber is characterized by an intermediate relaxation behaviour. Well separated from both is the NMR signal of Spin Finish. Therefore, Spin Finish can be observed and quantitatively analyzed by routine TD-NMR methods.



Prepare

## Sample Preparation

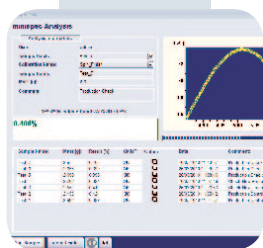
A simple one minute procedure:  
insert the fiber material into the non-breakable tube.



Measure

## Measurement

Analysis is automatically triggered by inserting the tube into the minispec.



Result

## Result

A couple of seconds later, the result is written into a concise data table.

## Applicability of Spin Finish Method

Bruker has proven in multiple studies that TD-NMR methodology works well for almost all types of fibers and Spin Finishes. Based on this experience of many years, multiple proven methods have been released, e.g. for

- technical and textile fibers
- multifilament, monofilament, staple fibers as well as texturized samples
- polyester, polyamide, polypropylene, polyethylene, polyacrylonitrile fibers and yarns
- polypropylene, polyethylene nonwovens

## Methods

Bruker offers both weighless and weight-normalized methods. Individual needs of our customers will help them decide which method to apply. The following quick guide indicates which method should be chosen:

### Weighless Method

- high sample throughput
- fastest sample preparation
- medium to high Spin Finish levels

### Weighing Method

- highest accuracy / precision and repeatability
- low to high Spin Finish levels

## Clean & Convenient



**Clean:** Using the minispec means avoiding the use of solvents, which is beneficial for the operator's health and our environment.

**Convenient:** Sample handling, minispec operation and data archiving have been designed for maximum convenience.



## Procedure

In order to accommodate the fiber material into the sample chamber of the equipment, the sample is loaded into sample tubes. Non-breakable tubes with premarked stopper positions and stoppers are available for fast and safe sample loading. Depending upon the method applied, sample weighing might be required. For calibration of the minispec and analysis of unknowns, the tube is inserted into the minispec and the TD-NMR signal is detected. Finally the NMR data is used to calculate the result of an unknown or to create / adjust a calibration curve.

## Calibration Procedure

During the last couple of years, co-operations with customers together with software and hardware developments have enabled Bruker to simplify calibration procedures significantly:

- for quick start-up, pre-configured minispec systems are delivered with Bruker Calibration Transfer and Validation standards.
- our Calibration Transfer and Validation standards can be used for periodical instrument check.
- software option for calibration transfer to other instruments for the first time in TD-NMR. Calibrate one master unit and transfer the calibration to other minispec systems by using the Bruker Calibration Transfer and Validation standards.
- general preparation recipe is available for calibration standards of non-standard fibers.

## The Spin Finish Software Interface

The software ensures simple step-by-step procedures together with state-of-the-art data archiving (results, calibration). Features of the Spin Finish software interface (minispec Plus Software Package):

- good Laboratory Practice (GLP) conformity
- 21CFRpart11 conformity for the first time in TD-NMR. An important laboratory preparation for the future.
- fully automatic system check and system setup procedures
- fully automatic data logging functionality
- user-friendly MS-Windows software
- Definition of various user permissions, e.g. for shift personnel or laboratory supervisors.
- LOG-IN procedure at start-up.
- simple and intuitive calibration procedure with Bruker preselected parameters for Spin Finish application.
- multi-lingual minispec Plus Software, supporting actually 9 different languages, like Chinese, English, French, German, Japanese, Russian, Spanish, Turkish
- results are saved automatically in database, manipulation of results is impossible.

### Secure & Best Quality



**Secure:** No need to worry about your minispec data integrity. GLP and 21CFRpart11 ensure nothing valuable will be lost or damaged.

**Best Quality:** A decision for the Bruker minispec is an investment in highest quality hardware, software and support.

### Versatile, Fast & Extendable



**Versatile and Fast:** Analyze all types of fibers. Reconfigure the system quickly for other applications, such as polymer analysis.

**Extendable:** Extend the minispec with an autosampler or a barcode reader accessory.

## Unique Advantages of minispec Hardware

Due to Bruker's long-standing experience with all available magnetic resonance techniques such as high-resolution NMR, solid-state NMR, Magnetic Resonance Imaging (MRI) and of course TD-NMR, our development group was able to add unique features to the minispec.

- the most stable magnet design for optimum performance - enabling reliable results.
- robust radio frequency components and digital electronics
- minispec units are hermetically closed; dust cannot affect the minispec boards. This insures ultra-long term operation of the minispec, even in dusty environments.
- magnet as well as electronics are in a temperature-stabilized housing for utmost results stability.
- almost service-free operation of the minispec

## High Sensitivity Design

Following the textile industry's trend to produce with lower Spin Finish levels, the development of the latest minispec series was driven by the request to design an instrument with significantly increased sensitivity.

Our high sensitivity design has following advantages:

- even the lowest Spin Finish concentrations can be analyzed
- highest results stability / best repeatability
- system is always perfectly matched independent of sample variation.

## Automation of minispec

Optionally sample changers can be offered / recommended, the local Bruker office can provide further details.

Advantages of automation:

- Analysis of all samples can be started by a single mouse click. The system can run all samples without further operator actions required.
- A barcode reader can be added to directly track samples.
- The results are automatically stored into databases and visualized in clearly arranged tables.



## Precise & Accurate

The minispec repeatability is at least 2-3 times better than any classical wet chemical method, e.g. Soxhlet extraction.

## More than 30 Years of Experience

Since the 1970's Bruker has created six generations of minispecs. The minispec was first introduced for the determination of the so-called Solid Fat Content (SFC) in fat compositions used in food industries. This application was developed in co-operation with Unilever Research, The Netherlands, and became an International Standard Method (AOCS, ISO, IUPAC). Along with its successful introduction for SFC into food industries, there was no question that the application of the minispec could quickly be expanded into other areas. Chemical, polymer, and textile industries started to make use of this very attractive technology. Polymer characterization, additives, and soluble fractions are just a few of multiple applications that became recognized methods. The latest generation minispec is a product of 30 years of experience with the Spin Finish application. Numerous innovative features have helped the mq-series minispec win the coveted R&D 100 award for the second time in the history of the minispec as an analytical tool for quality control and quality assurance. The new mq-one series guarantees highest performance quality and stability of the results.

# • Pros & Cons of minispec Method

- speed of minispec analysis
- no solvents
- high reproducibility
- non-destructive analysis
- analysis by untrained personnel
- user-friendly procedure
- results solvent independent

- financial investment
- introduction of new technology

## Return on Investment (ROI) Calculator

Fill in the average number of analyses per day and calculate the number of days until investment is balanced

$$\boxed{\text{Number of days until investment is balanced Break even}} = 4000 / \boxed{\text{Average number of analysis per day}}$$

or check the table on the right.

## Financial Aspects of minispec Acquisition

On a very conservative basis, it can be estimated that each wet chemical analysis replaced by a minispec analysis will save about 10 EUR/USD. This estimate considers reduced labor cost and elimination of the cost associated with purchasing, using, and disposal of solvents. This means that after approximately 4000 analyses, the minispec purchase costs can be recovered. Assuming 50 analyses per day, a return on investment can be realized within 3 months. Besides the above cost benefits, the benefits to operator health, workplace safety, and environmental aspects are significant.

## Return on Investment (ROI) Table:

Analyses per day	Days until investment is balanced
1000	4
500	8
200	20
100	40
50	80
20	200
10	400
5	800

### Note:

This simple calculation deals with direct cost of analysis. It does not consider the amount of money a company might loose if tons of product are rejected or are downgraded or need to be reworked or recycled due to out-of-limit production. It is possible that only ONE out-of-spec production run, noticed too late due to slow classical extraction methods, would cost the manufacturer the equivalent of the minispec purchase cost.



We provide a worldwide expert system support



We offer our customers regular training courses.



We provide competent service to ensure that your minispec system is always ready for operation.

## Application Consulting

minispec application groups located in key sites around the world provide expert system support, method development, and application improvement.

Bruker ensures high-quality support for our customers through:

- Annual training courses for technicians and applications scientists
- Direct support through telephone and electronic communication
- On-site visits and consulting.

Our corporate philosophy and commitment guarantees that customers who select Bruker as their supplier have a long-term, reliable partner.

## Training

Customer training courses are offered on a regular basis for the benefit of the instrument users. Customized on-site training is also available from our staff of application specialists. Individual training sessions at Bruker can be arranged as well.

A visit to a Bruker facility provides the opportunity for customers to see all configurations of the minispec at once, together with a full range of accessories. Visitors to our German site are invited to tour our main production facility.

## Service

Bruker Optics instruments are intended to provide years of trouble-free operation, but should a problem occur a network of Bruker companies and representatives around the world are ready to respond to your needs. Professional installations and a high standard of post-delivery service are commitments Bruker Optics makes to each of its customers.



**Bruker BioSpin**  
is ISO 9001 certified.

Magnetic safety measures apply to the operation of the minispec.

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Bruker BioSpin is continually improving its products and reserves the right to change specifications without notice.