THE COLLECTIONS OF THE THESES FOR THE SEVENTH BEIJING INTERNATIONAL CONFERENCE ON MAN-MADE FIBRES

第七届北京国际化纤会议

论 文 集

北 京 国 际 化 纤 会 议 组 织 委 员 会

ORGANIZING COMMITTEE OF BIMFC

THE COLLECTIONS OF THE THESES FOR THE SEVENTH BEIJING INTERNATIONAL CONFERENCE ON MAN-MADE FIBRES

第七届北京国际化纤会议论文集

SUBJECT

- Man-made Fiber Industry Reconstruction and Future Development
- Latest Process Technology
- Environmental Protection

主题

—化纤产业结构调整和发展趋势
—化纤生产新工艺、新技术
—化纤生产环保问题

北京国际化纤会议组织委员会
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后　　记

本论文集于一九九八年五月二十四日印制完毕。本届会议收到领导讲话及国内外论文共27篇，内容涉及全球化纤产业结构调整和发展趋势，化学纤维生产新工艺，新技术以及化纤生产环保问题。文字浩繁、工作量极大。在编制过程中，得到中国纺织总会国际合作部、中国纺织总会化纤办、中国化纤工业协会、中国纺织国际交流中心、中国纺织工业设计院、中国纺织科学研究院、北京力邦行咨询有限公司、北京印媒图文制作中心等单位的大力支持与合作，参加编辑、翻译、校对和打印工作的同志付出了辛勤的劳动，在此表示衷心的感谢！

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第七届北京国际化纤会议组委会

Organizing Committee of the 7th BIMFC'1998

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化学纤维制造新技术

普拉斯蒂尼先生　SNIA 工程公司

1 前　言

SNIA 在粘胶连续长丝生产方面的工作开始于六十年代初，包括纺丝机的设计及新型长丝机的开发。三十多年来，在粘胶长丝连续纺丝工艺和设备的进展已是成效显著，总结如下：

	六十年代	七十年代	八十年代	九十年代
单元长丝股数	1	2	4	4
纺丝速度(m/min)	80	100	140	180
股丝洗涤	Na_2S + NaCLO	无离子水(密闭)	无离子水(密闭)	无离子水(开放)
卷绕类型	环锭	环锭	平行	平行
丝网重量(kg)	2	2	6	10

目前 SNIA 公司粘胶长丝产品范围如下表：

有光丝 dtex/根丝	消光丝 dtex/根丝	原液染色 dtex/根丝	超细长丝 dtex/根丝	扁平状丝 dtex/根丝	粗细丝 dtex/根丝	高粘合力(抱合力)丝 dtex/根丝
40/14	—	—	—	—	—	—
60/20	—	—	—	—	—	60/20
85/30	85/30	85/30	85/30	—	—	85/30
110/38	110/38	110/38	—	—	—	110/38
135/44	135/44	135/44	—	—	—	135/44
170/50	170/46	170/46	170/160	170/46	170/46	170/50
220/46	220/46	220/46	—	—	—	220/46
330/56	330/56	330/56	—	330/30	330/56	330/56
500/80	—	—	—	330/80—	—	
660/112	660/112	660/112	—	—	—	—

以上品种纺丝速度变化范围从 60m/min(也就是纺 330dtex/56 根粗细丝(到 180m/min(也就是 110dex/38 根，135dex/44 根有光丝)。

2 技术开发

为了跟上高级化及多样化的市场需要的步伐,SNIA 公司已进行的如下技术开发工作:

2.1 原液染色

已经设计了一种将颜料注射进原液中的手提式(便携式)的设备以用于本体染色及消光丝的生产。

2.2 特殊长丝

开发超细及扁平截面丝束需对粘胶原液性能进行透彻的研究。由此得出结论为此需使用低盐值的粘胶以利于克服丝条断裂及截面的均匀性等问题。

2.3 高粘合(抱合)力长丝

高粘合力长丝定义如下:为了可用于传统的整经设备以含油剂量为 4.5% 的长丝束,代替标准的含油剂量为 2.5% 的长丝。

实际上,粘胶连续长丝由于它是平行绕绕的,故不能直接在传统的整经设备上使用。通常有二种费用较贵的解决方法,也就是说或者将长丝加拈,或者在一种特殊的整经设备上整经。

SNIA 开发了一种较为便宜的方法,它包括改变纺丝工艺参数及使用含有高粘合力成份的油剂乳液,而不需添加物或增加设备。其中关键在于这种高粘合力成份必须和油剂混和在一起。

实际上试验时在油剂乳液中增加粘合剂的浓度会引起下列主要的负面影响。

——在纺丝机的主辊,小辊筒及导丝盘上产生严重的结垢现象,以致几乎 48 小时需停车清理一次。

——由于该油剂溶液的退浆性能极差,最终对丝束的染色均匀性产生不利影响。

在进行了一系列试验后,采用了一种化学成份完全不同的粘合剂,它可消除上述负面影响。在印度纺出(含油量为 4.5% 的)长丝,然后整经,染色,以试验这种高粘合性的丝束的下游工艺中的稳定性。

三家印度生产厂为:

——中央粘胶公司(Shahad)

——印度粘胶公司(Veyaval)

——Baroda 粘胶公司(Vadodara)

织了绸缎及丝绒二种织物。以绸缎为例,下游加工以下列工艺步骤进行。

整经

——分条整经机速度:250m/min

——经轴:8,340 根长丝,37 区分,每个区分 250m

——结果:无断头

织造

——织梭:125PPM

——25/根纬纱/CM

结果:常规织造的 146g/m^2 织物,无断纬。

退浆及染色

结果:退浆良好,染色均匀。

通过适当地调整纺丝工艺参数以及使用了新的粘合成份所得的良好结果,特别是在退浆及这二种成份在油剂乳液中的混合性能,使 SNIA 公司下决心改变通常标准的长丝产品(含油量为 2.5%)中的粘合成份。

该二种不同的油剂乳液差别汇总如下:

	油剂溶液(新)	油剂溶液(老)
稳定性	>48 小时	<0.5 小时
颜　色	透　明	微　黄
长丝光滑度	8÷9g	7÷8g
主辊/辊筒的清洗	45 天以后	30 天以后
二等品丝束	4%	5%
退浆性能	好	差
织物染色均匀性(灰色样卡)	≥4	≥3.5

3　研究及开发

SNIA 为在粘胶连续纺长丝方面保持领先地位,对原来的技术进一步进行开发,很久以前就超越了纺丝 160m/min 的界限。

现在,180m/min 的纺速很快就要成为 SNIA 公司的新的工业标准。

事实上在 Rieti 的 SNIA 工业设备上一年内进行了一系列的研究试验,目的是将纺速提高至 180 到 220m/min 的范围。

所有在试验设备上试生产的品种为 135dtex/44 根有光丝。这些试验的目的是找出最佳的工艺条件以使每个长丝位能以更高的产量生产出符合 SNIA 传统高质量标准的产品。

使用了因子试验方法,分析了一系列的软件(例如:工艺操作参数)及硬件(例如:纺丝机的改进及装配)等变数影响。

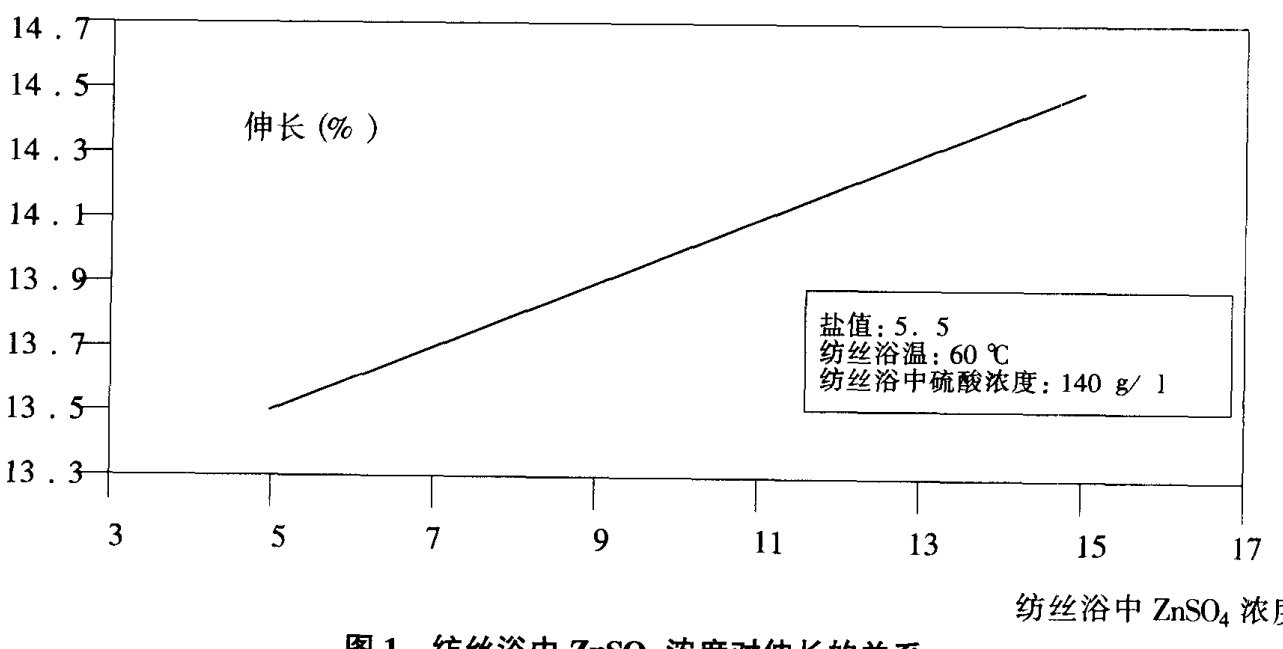

图 1　纺丝浴中 $ZnSO_4$ 浓度对伸长的关系

结果如下:采用了上述参数适当的结合,以 180m/min 以上的纺速所得丝束的质量绝不比任一"标准"丝束的质量差。

为简要起见,这里仅分析主要的力学性能,伸长及强度。相对于下列化学/物理工艺参数的变化:

——粘胶原液的盐值

——纺丝浴温度

——纺丝浴中 $ZnSO_4$ 浓度

——纺丝浴中 H_2SO_4 浓度

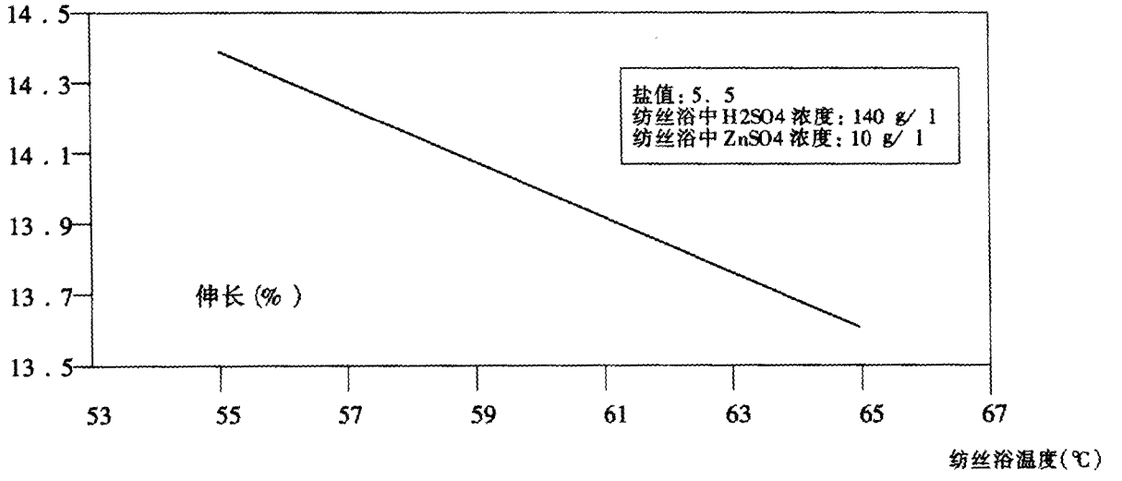

图 2　纺丝浴温对丝束伸长的关系

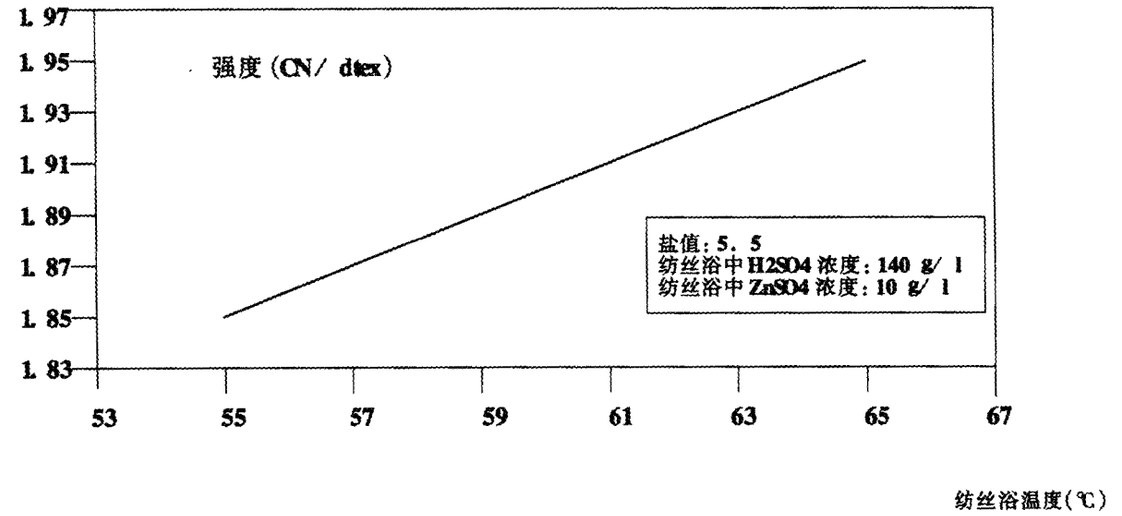

图 3　纺丝浴温度对丝束强度

回归模拟的结果显示在图一、二、三中。

试验显示了在调研的范围内粘胶原液的盐值以及 H_2SO_4 浓度对丝束的伸度和强力的影响是可忽略不计的。

4　结　论

在 180m/min 纺速以上的试验显示了该设想是可行的。

这将在不远的将来导至纺丝设备更为经济(较少的硬件)及对投资的回报更快。

粘胶连续长丝的纺速无疑会越来越快。

其中作为传统的工业生产者及工程公司，SNIA 将继续进行他们的实验性试验以保证 180m/min 以上纺速的产品，也将对能使设备更有益的重要的工业参数，如影响满筒率，一级品率及断头等工艺参数进行试验。

实际上，不仅低的原始投资，而且以恒定的产品质量为依据的设备的充分可靠性也是一个项目的经济上的可靠性的重要关键。

New Technology In Chemical Fibre Manufacture

Mr. F. Prestini Snia Engineering

1 Foreword

SNIA activity in Rayon Continuous Filament started in the early '60s, both in design of spinning machines and in the development of new filament types. In more than 30 years the progress of continuous spinning technology has been remarkable, as summarized hereinafter.

	'60	'70s	'80s	'90s
No of filaments per module	1	2	4	4
Spinning speed(m/min)	80	100	140	180
Yarn washing	Na_2S + NaCLO	Demi water (Closed loop)	Demi water (Closed loop)	Demi water (Open loop)
Take – up type	Ring	Ring	Parallel	Parallel
Bobbin weight(kg)	2	2	6	10

The current range of SNIA production is shown in the following table.

BRIGHT (dtex/fil)	DULL (dtex/fil)	MASS DYED (dtex/fil)	MICROFIL (dtex/fil)	RIBBON S (dtex/fil)	THICK AND THIN (dtex/fil)	HIGH GLUE (dtex/fil)
40/14	—	—	—	—	—	—
60/20	—	—	—	—	—	60/20
85/30	85/30	85/30	85/30	—	—	85/30
110/38	110/38	110/38	—	—	—	110/38
135/44	135/44	135/44	—	—	—	135/44
170/50	170/46	170/46	170/160	170/46	170/46	170/50
220/46	220/46	220/46	—	—	—	220/46
330/56	330/56	330/56	—	330/30	330/56	330/56
500/80	—	—	—	330/80—	—	
660/112	660/112	660/112	—	—	—	—

The above types are spun with speed varying from 60 m/min (e.g. 330/56 thick and thin) to 180m/min (e.g. 110/38, 135/44 bright)

2 TECHNOLOGY DEVELOPMENT

In order to keep the pace with the sophisticated and variable market demand, SNIA has undertaken the technological developments hereinafter summarized.

2.1 Mass dyeing

A portable system for pigment injection into the viscose dope has been designed and develped for the production of mass dyed and dull filaments.

2.2 Specialty filaments

The development of microfilament and ribbon (flat) section yarn has required a thorough study of the viscose dope characteristics. This led to the conclusion that a viscose with a lower salt index than usual has to be used for these specialties, in order to overcome problems such as yarn breakages, cross section evenness, etc.

2.3 High glue filaments

High glue filaments are defined as yarns having about 4.5% of finishing media content instead of the standard 2.5%, in order they can be utilized as such on conventional warping machines.

In fact, the Rayon Continuous Filament cannot be utilized directly on conventional warping machinese, due to the intrinsic characteristics of the parallel take – up. the problem can be traditionally overcome in two noncostless ways, i.e. either by twisting the filament or by warping it on a special warping machine.

A less expensive alternative developed by SNIA consists in both modifying the spinning process parameters and utilizing a finish emulsion with higher glue content than normal without additions and/or increases of hardware.

One critical point, among the others, is the type of glue that has to be mixed together with finishing oil.

In fact, the increase of glue concentration in the finishing emulsion during the tests led to the following main negative factors.

—Heavy fouling of main roll, rollers and yarn guides of the spinning machines, which required to stop the process aimose every 48 hours.

—The very bad desizing behaviour of the finishing solution, which eventually negatively affected the dyeing uniformity of the yarn.

After a series of test, a new type of glue with different chemical basis was utilized, which contributed to eliminate the above negative effects. The filaments so spun (with 4.5% finishing content) were thereafter warped, woven and dyed in India, in order to test the suitability of this high glue yarn to the donwstream processing. The three producing companies were:

—Century Rayon(Shahad)

—Indian Rayon (Veraval)

—Baroda Rayon (Vadodara)

Two different kinds of fabric were woven, namely satin and velvet. For the satin, for example, the

following steps were involved.

Warping

- – Speed of sectional warping machine:250m/min
- – Beam: 8,340 filament, 37 section, each section 250m
- – Results: no breakages

Weaving

- – Loom shuttle: 125 ppm
- – 25 weft insertions per cm

Resuit: regular weaving of a 146 g/m fabric, no weft breakages

Desizing and dyeing

Result: Good desizing and dyeing uniformity.

The positive results so obtained by properly adjusting the spinning parameters and with the help of the new kind of glue, particularly with respect to the desizing and mixing behaviour of the two compounds in the finish emulsion, convinced SNIA to change the type of glue also on the "standard" filament production (2.5% of finishing media content).

The differences between the two different finishing emulsions are summarized hereinafter.

	FINISHING SOLUTION (New)	FINISHING SOLUTION (Old)
Stability	> 48hours	< 0.5hours
Colour	Transparent	Yellowish
Filament smoothness	8 ÷ 9g	7 ÷ 8g
Drum/rollers cleaning	After 45 days	After 30 days
2nd choice yarn	4%	5%
Desizing behaviour	Good	Poor
Dyeing uniformity on fabric (grey scale)	≥4	≥3.5

3 REASEARCH &DEVELOPMENT

In order to keep the front running position in Continuous Spinning, SNIA is further developing their original technology, the threshold of 160 m/min spinning speed having aiready been crossed long time ago.

Nowadays, the 180 m/min spinning speed is on its way to become soon the new industrial standard in SNIA.

As a matter of fact, a series of research tests were made during one year in SNIA industrial plant in Rieti, with the purpose of furtherly increasing the speed in the range between + 180 and 220 m/min.

All the tests have been made on a pilot plant with 135/44 bright yarn.

The goal of the tests was to find out the optimum process conditions so as to obtain a higher output per

position of a filament having the traditional high quality standards of SNIA production.

The factorial testing method was applied, analyzing anumber of soitware (e.g. process operating parameters) and hardware 9e.g. spinning machine modifications and set-up) variables.

The results have shown that, utilizing a proper combination of the a.m. factors, the quality of the yarns obtained in the spinning range above 180 m/min is definitely not inferior to the one of "standard" yarn.

For the sake of brevity, only the main dynamometric characteristics will be analyzed here, namely elongation and tenacity, versus the following chemicalphysical operating pararmeters:

- - Salt index of viscose dope
- - Spinbath temperature(℃)
- - $ZnSO_4$ concentration in spinbath
- - H_2SO_4 concentration in spinbath

The results of the regression model are shown in the diagrams no 1,2 and 3.

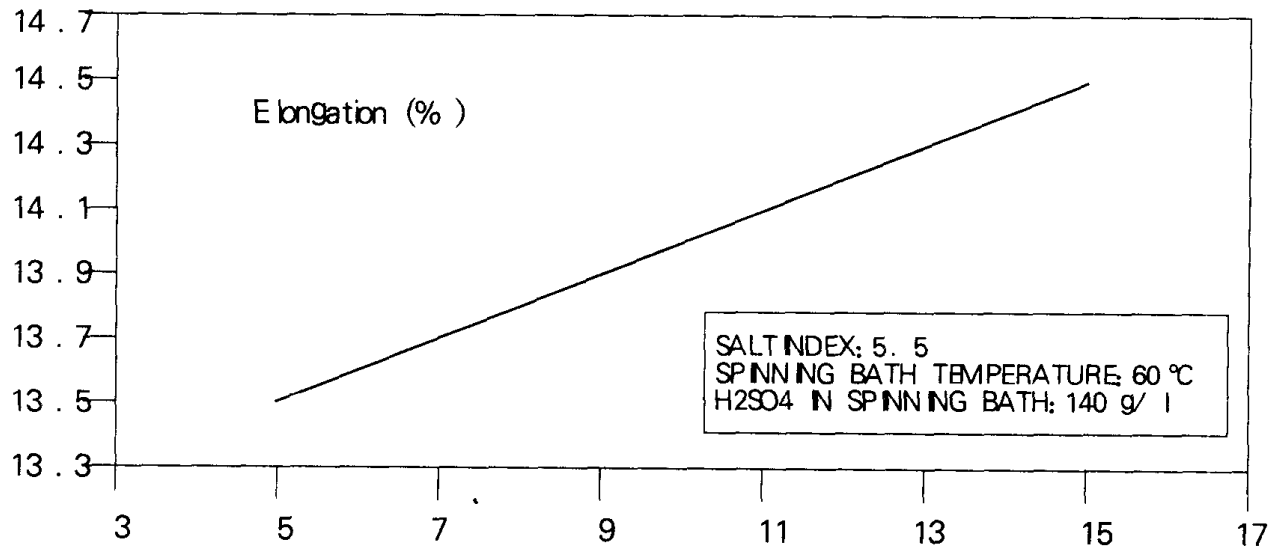

DIAGRAM No 1 SPINNING BATh $ZnSO_4$ CONCENTRATION VS YARN ELONGATION

(MODEL CORRELATION)

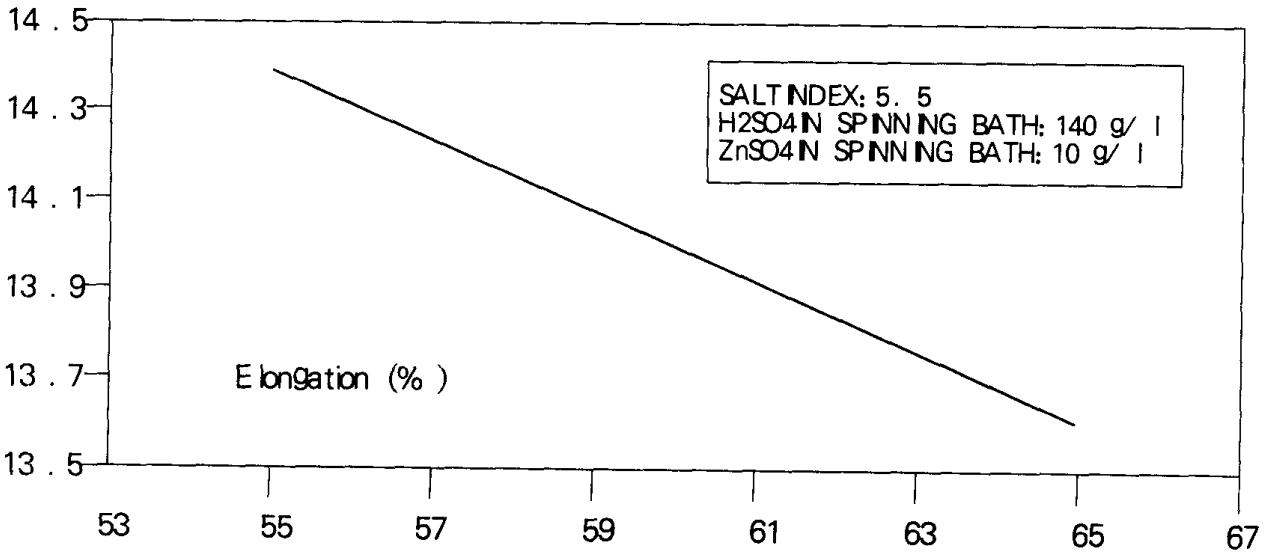

DIAGRAM No 2 SPINNING BATH TEMPERATURE VS YARN ELONGATION

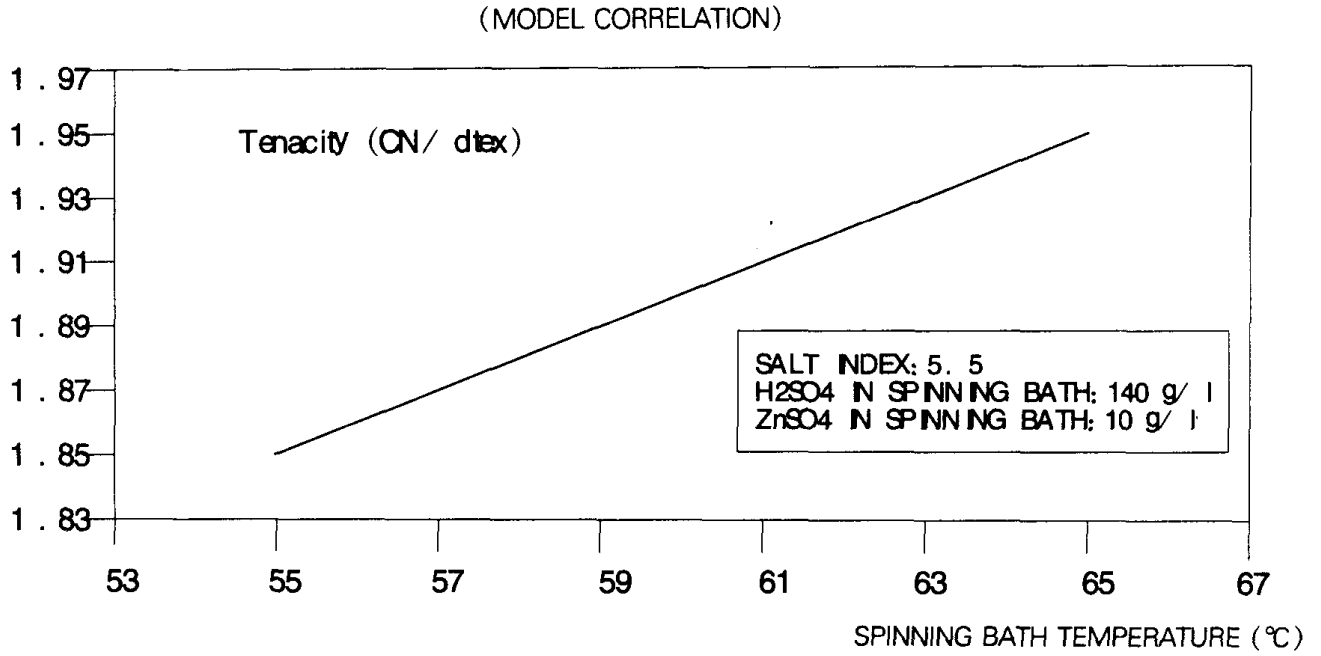

DIAGRAM No 3 SPINNING BATH TEMPERATURE VS YARN TENACITY

(MODEL CORRELATION))

The tests have demonstrated that the influence of viscose dope salt index and H_2SO_4 concentration on elongation and tenacity of the yarn are negligible, in the investigated range.

4 CONCLUSION

the tests on operational speed range above 180m/min have shown the feasibility of this idea.

This will eventually lead, in a short future, to spinning plants even more economic (less hardware) and with a much faster return on investment. The spinning speed in Rayon Continuous Technology will definitely become faster and faster.

In line with its tradition of industrial producers and engineers, SNIA is going on with their experimental tests in order to guarntee the yarn spun over 180m/min also with respect to the important industrial prameters that can make the plant profitable such as full bobbin rate, first choice ratio, breakages, etc.

In fact, not only a low initial investment, but also the full plant reliability in terms of constant quantity and quality are important key points that determine the economic feasibility of a project.

全球尼龙行业，原料的供应及需求

DSM 公司　*J. Prins* 经理

1　导言

尼龙是最早的合成纤维之一，其主要产品尼龙 6 及尼龙 66 早在三十年代就已发明。正由于尼龙性能优良，导致在全球纤维市场中占有重要地位，目前每年尼龙产量约为 390 万吨。

尼龙 6 及尼龙 66 的发展历史是十分不同的，例如，发展初期所涉及的生产公司采取的生产路线就是不一样的。尼龙 66 行业的特征是从原料直至最终纤维成品联合在一起生产，这就局限于少数大公司。尼龙 6 行业是建立在许多公司基础上，只有少量是从原料至纤维整体生产的。

本文将阐述尼龙 6 及尼龙 66 的原料部分，本文是代表尼龙 6 推销集团(NPG)来写的，这是由最初领导着己内酰胺生产者组成的行业供销集团。所有的数据均有 PCI 纤维及原料咨询公司出版的综述为依据。

2　全球纤维要求

图 1 指出过去及预测的今后全球纤维需求量。纤维分为天然纤维(以深色部分表示)及化学纤维(浅色部分表示)。两类中的主要纤维都列入图中。

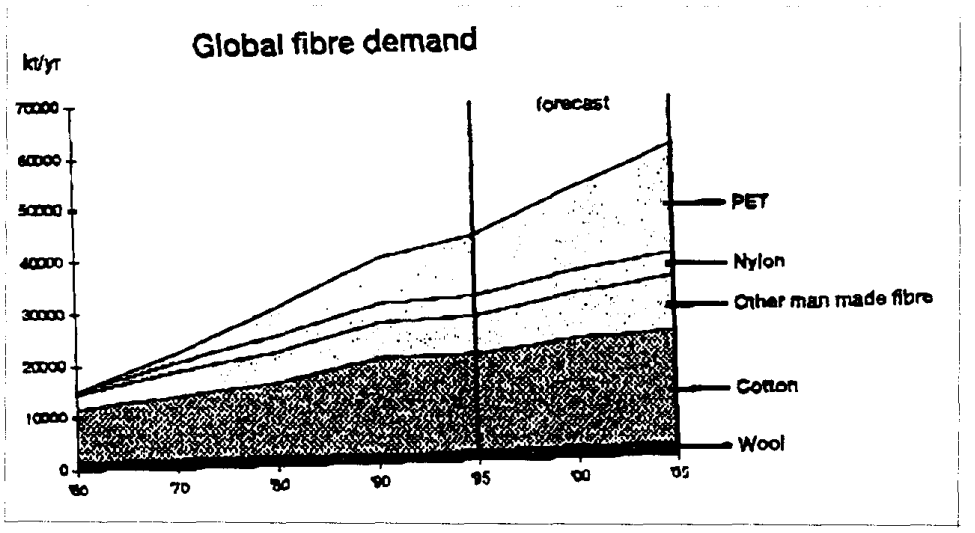

图 1　全球纤维需求

由于世界人口及其生活水准不断提高，纤维需求也像上图所示在增加。而且世界人口的增加，也会对用于粮食生产的可耕地的需要增加，这对棉的销售比例产生负面影响。

如图所示，涤纶替代棉花的能力是显然的，尼龙也显示稳定的增长。这主要是由于尼龙优良的性能所致，它是特种应用的基本材料。