



TECHNICAL NOTE 1701: NOMENCLATURE FOR RECYCLED CARBON FIBRES



Introduction

ELG Carbon Fibre Ltd processes waste carbon fibre from many sources. In order to ensure that we provide our customers with products that deliver a consistent level of performance, we operate a strict system of fibre testing and classification. Once the properties of a batch of fibres have been determined, those fibres are given a designation based on the fibres' mechanical properties and source.

Fibre Classification

Fibres are classified depending on the type of waste from which they were recovered, and the mechanical properties of the fibres.

Fibres extracted from waste materials are generally not aligned, so fibre mechanical properties are determined by single filament testing. This is different to the impregnated strand test method used to determine the mechanical properties seen on datasheets for virgin fibres, and because only a single filament (as opposed to a bundle of 3,000 – 50,000 filaments) is being tested, mechanical properties are generally lower than seen on datasheets.

This is illustrated by the comparison below, where the properties of a piece of carbon fibre tow were determined using both methods.



Figure 1: Single filament test on carbon fibres

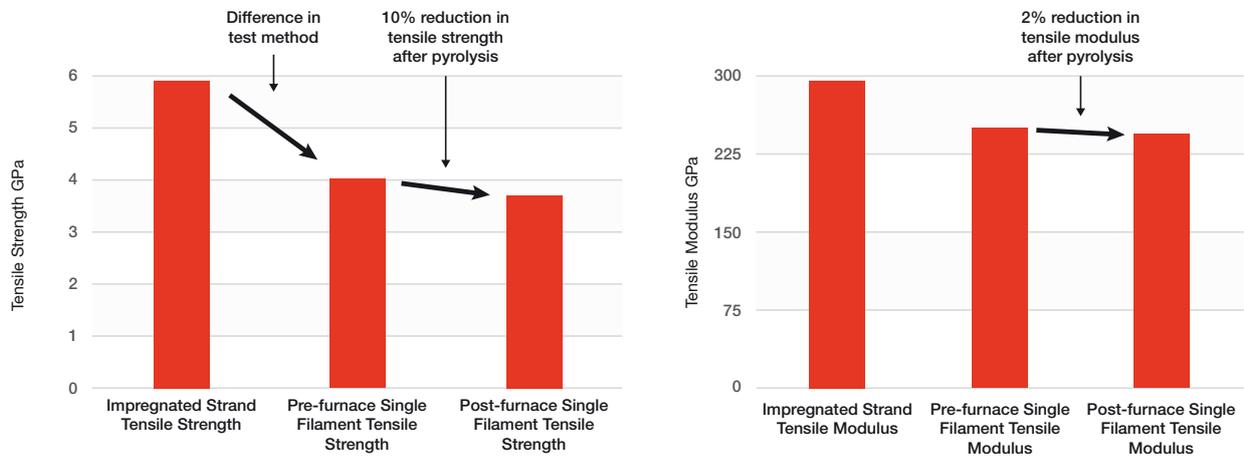


Figure 2: The tensile strength (left) and modulus (right) for virgin and recycled fibres, comparing the impregnated strand test to a single filament test.

ELG tests fibre properties both on receipt and where fibres are recovered and cleaned using ELG’s patented pyrolysis process. Depending on the results of this testing, fibres are given a designation that reflects the properties of the fibre.



Fibre Nomenclature

ELG has developed a coding system to classify the carbon fibres recovered from waste material. This uses a five-digit code to describe the stiffness, strength and origin of the fibre. The first two letters state the modulus category of the fibre, the next two digits give the strength range of the fibre in GPa and the final digit indicates the source of the fibre.



Modulus (GPa)		Strength (GPa)		Source	
SM	Standard: to 270	23	UTS between 2 & 3 GPa	D	Dry fibre, still with sizing
IM	Intermediate: 270 < E < 330	34	UTS between 3 & 4 GPa	R	Desized dry fibres
HM	High: 330 < E < 460	45	UTS between 4 & 5 GPa	P	Fibres recovered from pre-preg
UM	Ultra-high: over 460	56	UTS between 5 & 6 GPa	L	Fibres from cured waste
		67	UTS between 6 & 7 GPa		

Table 1: The ELG carbon fibre classification system.

Thus a fibre designated IM56L is an intermediate modulus fibre with a tensile strength between 5 & 6 GPa recovered from laminate waste. Where fibres are resized, an additional two letter code is used to show that the fibres have been resized, and to indicate the type of size used. Table 2 shows the sizes applied to ELG’s range of CARBISO™ CT+ products. Other codes will be added as the range is extended.

Sizing Code	Meaning
00	No sizing applied
E0	General purpose epoxy sizing
E1	Epoxy compatible sizing, variant 1
A0	Polyamide compatible sizing
U0	Polyurethane compatible sizing
V0	Vinyl ester compatible sizing

Table 2: Additional codes to designate sizings applied to recycled carbon fibres

Special Conditions

Whilst ELG’s system for fibre classification ensures it can deliver customers products that provide a consistent level of performance, it is recognised that there are some instances, particularly in closed loop recycling situations, where even tighter control of the fibres being used to make a particular recycled carbon fibre product is desirable. In such cases, the fibre classification and naming system described above is still used, however tighter control on the selection of fibres is provided through the use of individual product specifications.



Disclaimer

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