Celestial Collection

Laura KNOELL & Eléonore BONHOMME

INTRO

DESCRIPTION

In the manner of the "ready-made", six fabrics composed of metallic monofilaments have been diverted from their technical uses in order to create a capsule collection of eight outfits and two handbags, called Celestial.

OBJECTIVE

Characterize metallic fabrics and imagine a possible use of fabrics based on metallic filaments for "clothing" type applications. Consider extending the concept to precious metals.

WEBSITE

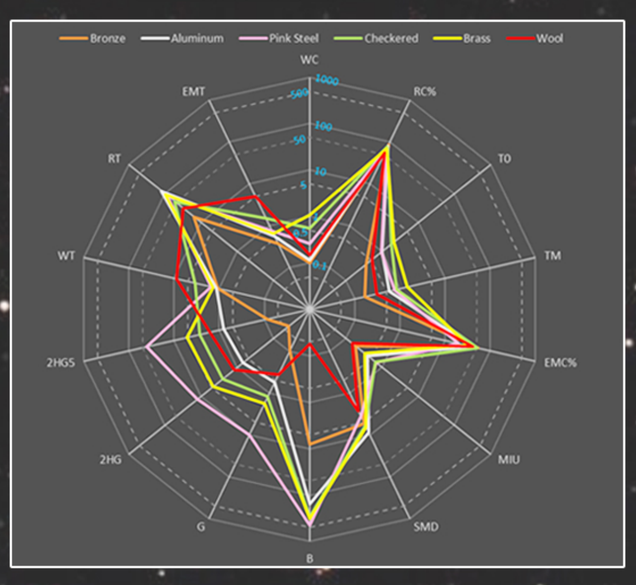
http://celestialcollection.fr/

STATE OF THE ART

Artistical point of view: Paco Rabanne's dress, made of square and rectangular aluminum plates connected by metal rings. Technological point of view: Kawabata Evaluation System (KES) to examine the physical and surface properties of fabrics under low stress.

KES

During the making of the clothes: Highlighting of numerous difficulties linked to the mechanical characteristics of fabrics. Use of KES to show high shear, high bending stiffness and lack of elasticity for some fabrics.



	Name of the parameter	Unit
WC	Compression energy	gf.cm/cm²
RC%	Compressional resilience	%
T0	Fabric thickness at a very low compressive load (0.5 g/sq.cm)	mm
TM	Fabric thickness at the maximum compressive load (50 g/sq.cm)	mm
EMC%	Compressibility	%
MIU	Coefficient of friction	-
SMD	Geometric roughness	µm
B	Bending stiffness	gf.cm²/cm
G	Shear stiffness	gf/cm.deg
2HG	Hysteresis of shear force at shear angle of 0.5°	gf/cm
2HGS	Hysteresis of shear force at shear angle of 5°	gf/cm
WT	Tensile energy or work done in tensile deformation	gf.cm/cm²
RT	Tensile resilience	%
EMT	Extensibility, tensile elongation	%

Comparison between metallic fabrics and wool:

→ For compression and surface parameters: metallic fabrics are similar to wool fabric

→ Bending stiffness B : metallic fabrics are definitely stiffer than wool

→ Shear stiffness G: bronze fabric has a small shear stiffness that prove what we observe during the sewing process

→ Extensibility EMT: metallic fabrics are 5 times less extensible than a basic wool fabric

The results obtained show that the KES could not be used as such for the assessment of the confectionability of fabrics based on metallic wires.

→ KES-FB1: The applied force is not sufficient to compress the metallic structure, the measure is distorted because the metallic fabric is not perfectly flat

→ KES-FB2: The spacing between the filaments is greater than the dimension of the probe which gets stuck in the structure during measurement

→ KES-FB3: The measured stiffness values are outside the value range of the modulus

→ KES-FB4: Shear values could be measured, for some fabrics the values obtained made it possible to conclude that there was good confectionability

With our creations and by proving that some characteristics of metallic fabrics are similar to wool fabric, we have shown that it is possible to realize outfits with metallic fabrics, but their realization was very complex and cannot be reproduced in an industrial context. It could be interesting to find a new sewing process to optimize the confectionability of these metallic fabrics.

MTS

By creating the Celestial Collection, we proved that the making of outfits with metallic fabrics was possible. We then wanted to broaden our perspectives by imagining our concept applied to precious metals like gold.

Comparison of the different mechanical properties of bronze yarns extracted from our fabric (warp and weft) and gold yarns annealed (99.99% pure) of the same diameter (0.08 mm), with the MTS traction dynamometer, in order to know if those gold yarns could be woven.

	Bronze (warp)	Bronze (weft)	Gold
Maximum strength (N) :	1,86	2,13	1,03
Breaking strength (N) :	1,47	1,67	0,92
Breaking elongation (mm) :	35,21	136,15	10,96
Breaking strain (%) :	7,04	27,23	2,28
Specific modulus (MPa) :	0,72	0,66	0,61
Absorbed energy (J) :	58,77	267,60	10,75
Tenacity (cN/tex) :	3,55	4,03	1,05

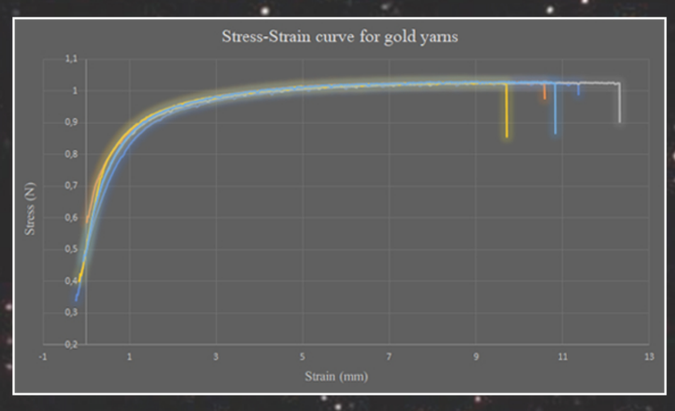
Higher values for bronze wires in weft direction, possible reasons:

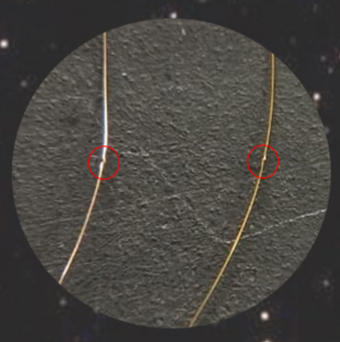
→ Greater stress on warp yarns during weaving: deformation beyond their elastic recovery (plastic)

→ Lower tensile elongation at break for bronze warp yarns

Very weak breaking force for gold wires: worrying for weaving

However, breaking elongation for gold (about 1 cm) not lower than for flax, kevlar or carbon fibres





→ Numerous yarns with tear initiations → test duration too short according to standard ISO 2062:2009 → many invalid tests

→ Possible reasons for bronze: yarns taken from the fabric that has been folded and twisted + stresses during weaving

→ Possible reasons for gold: faults during spinning or welding points between different wires

Comparison Bronze/Gold not conclusive: values for gold too low compared to bronze

Standard weaving conditions without problems: deformation > 4% and tenacity > 8 cN/tex

Gold wires would be difficult to weave: solutions could be considered to improve elongation and avoid breakage during weaving as much as possible, such as a suitable heat treatment.

SECURITY

→ Study of the possibility of induced currents in a metallic dress exposed to a strong magnetic field (risk of electric shock)

→ Creation of a 0.00188 T magnetic field by using a hollow coil with a bronze fabric sample and measurement of the induced voltage with a voltmeter

→ Maximum of 30 volts obtained on the fabric

→ Result not alarming as this value is lower than the Very Low Security Voltage (50 volts according to standard NFC 18510) and for a magnetic field almost 19 times higher than the maximum allowed field in France (100 µT)

→ Electrical conductivity of bronze is 7.4×10^{-6} $S.m^{-1}$ while that of gold is 44.2×10^{-6} $S.m^{-1}$

It would be wise to repeat this test with other metals, also varying the wires' thickness and the number of yarns per cm to see if a real risk could exist.