

# Practical Methods to Estimate Fabric Mechanics from Metadata - Supplementary Material

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## 1. Model Implementation Details

For training both models, MECHMET and MECHIM, we used the Mean Absolute Error of the parameters as the loss function, and a different set of hyper-parameters for the *bending* and *stretch* models. For MECHMET, which is a Random Forest Regressor (RFR), we did 5-fold cross validation to find, for stretch: `min_samples_leaf=0.0148`, `min_samples_split=0.0455`, `max_depth=10`, `n_estimators=100`, `max_features=0.3`. For bending: `min_samples_leaf=0.0045`, `min_samples_split=0.0055`, `max_depth=10`, `n_estimators=100`, `max_features=0.3`. Training both models takes a few seconds. For MECHIM, we use a ResNET18 [HZRS15] as feature extractor and the following sizes for the architecture components. For stretch: MLP layers=2, with an `input_size=meta_size*positional_encoding + FC_size + composition_embedding_size`. The size of the layers was progressively halved until reaching the last layer, which has an output size of 3 (the three stretch parameters). For bending, MLP layers=5, and the `input_size` and size of the layers follows the same pattern as the MLP for stretch. The FC layer size is 5 for both models. The compositions were reduced using an MLP with 5 layers for stretch and 4 layers for bending. The size of the layers was also progressively halved until reaching the last layer, which has a size of 2. We used Adam optimizer with learning rates of 0.001 and 0.08 for stretch and bending models, and a learning rate decay of 0.78 for both models. For training the neural network we used crops of the images of size 256x256 and performed data augmentation by random perturbations of small rotations, gaussian blurs, and changes of saturation, contrast, and color. The training was done with a GeForce RTX 2080 Ti during approximately 150 epochs (about 20 minutes).

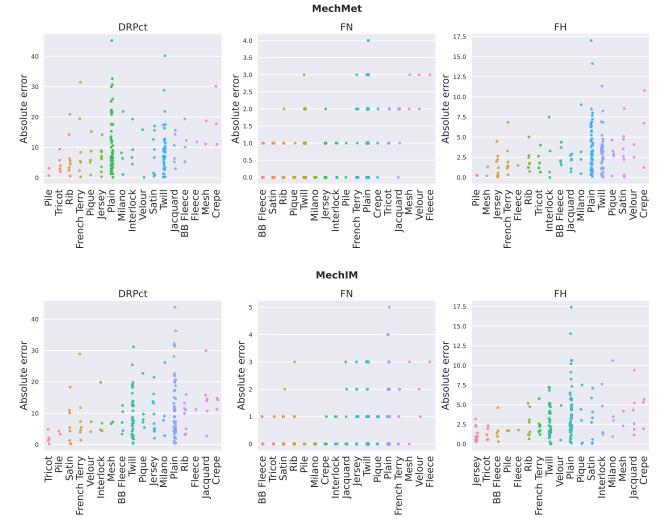
## 2. Cusick Results

In this section we show some extra results regarding the quantitative and qualitative performance of our models in the Cusick metric space.

### 2.1. Cusick Quantitative Results

In Figure 1 we evaluate the error in the Cusick metrics per family. As explained in the main document, Twill and Plain families have

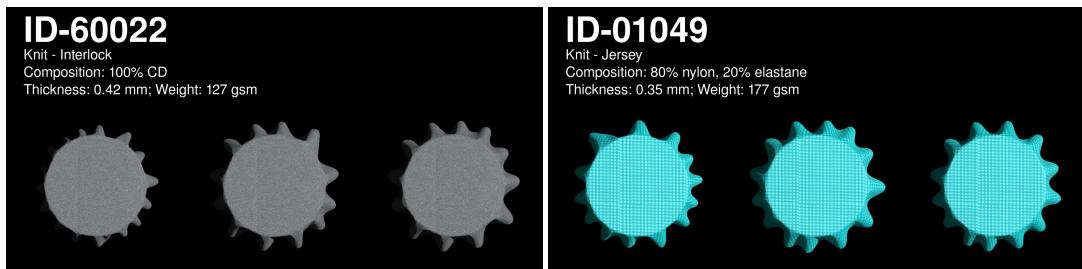
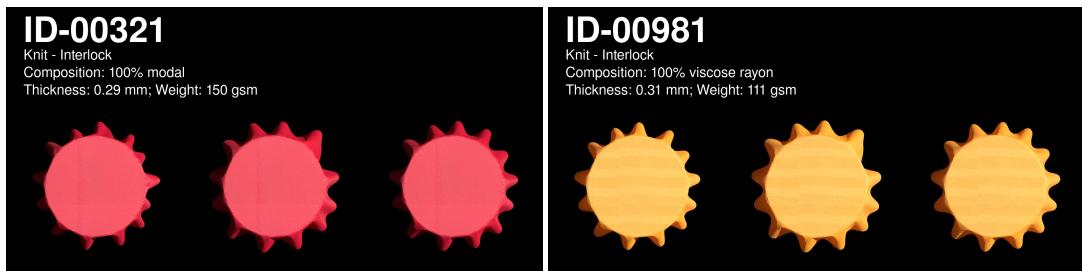
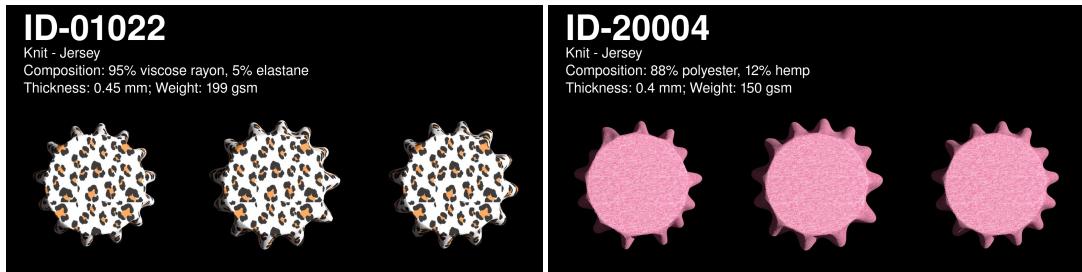
the highest variability of errors, because they group lot of smaller categories of fabrics. Also in this case both models struggle with families that are under represented in our dataset, like Crepe or Fleece.



**Figure 1:** (this figure is new) Absolute errors of DRPct, FN and FH of all the fabrics per family, sorted by increasing mean family error.

## 2.2. Cusick Qualitative Results

In the following pages we show a set of digitized fabrics from our test set sorted by the error of the Drape Coefficient (DRPct) in increasing order. Each figure contains drapes of the Ground Truth (left), the MECHMET model (middle), and the MECHIM model (right).



**ID-00834**

Knit - Mesh  
Composition: 92% nylon, 8% elastane  
Thickness: 0.31 mm; Weight: 119 gsm



**ID-00970**

Knit - Interlock  
Composition: 100% Tencel  
Thickness: 0.39 mm; Weight: 182 gsm



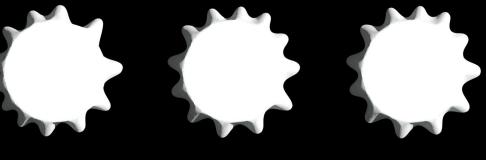
**ID-60006**

Knit - Jersey  
Composition: 90% polyester, 10% elastane  
Thickness: 0.43 mm; Weight: 159 gsm



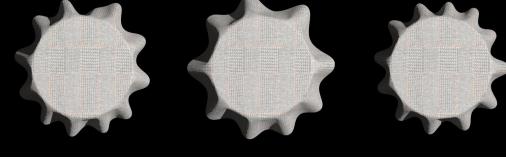
**ID-60014**

Knit - Jersey  
Composition: 90% polyester, 10% elastane  
Thickness: 0.44 mm; Weight: 166 gsm



**ID-00973**

Knit - Jacquard  
Composition: 70% Tencel, 30% wool  
Thickness: 0.61 mm; Weight: 156 gsm



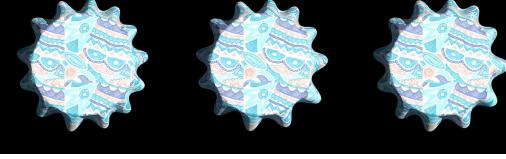
**ID-60013**

Knit - Jersey  
Composition: 90% polyester, 10% elastane  
Thickness: 0.44 mm; Weight: 168 gsm



**ID-01023**

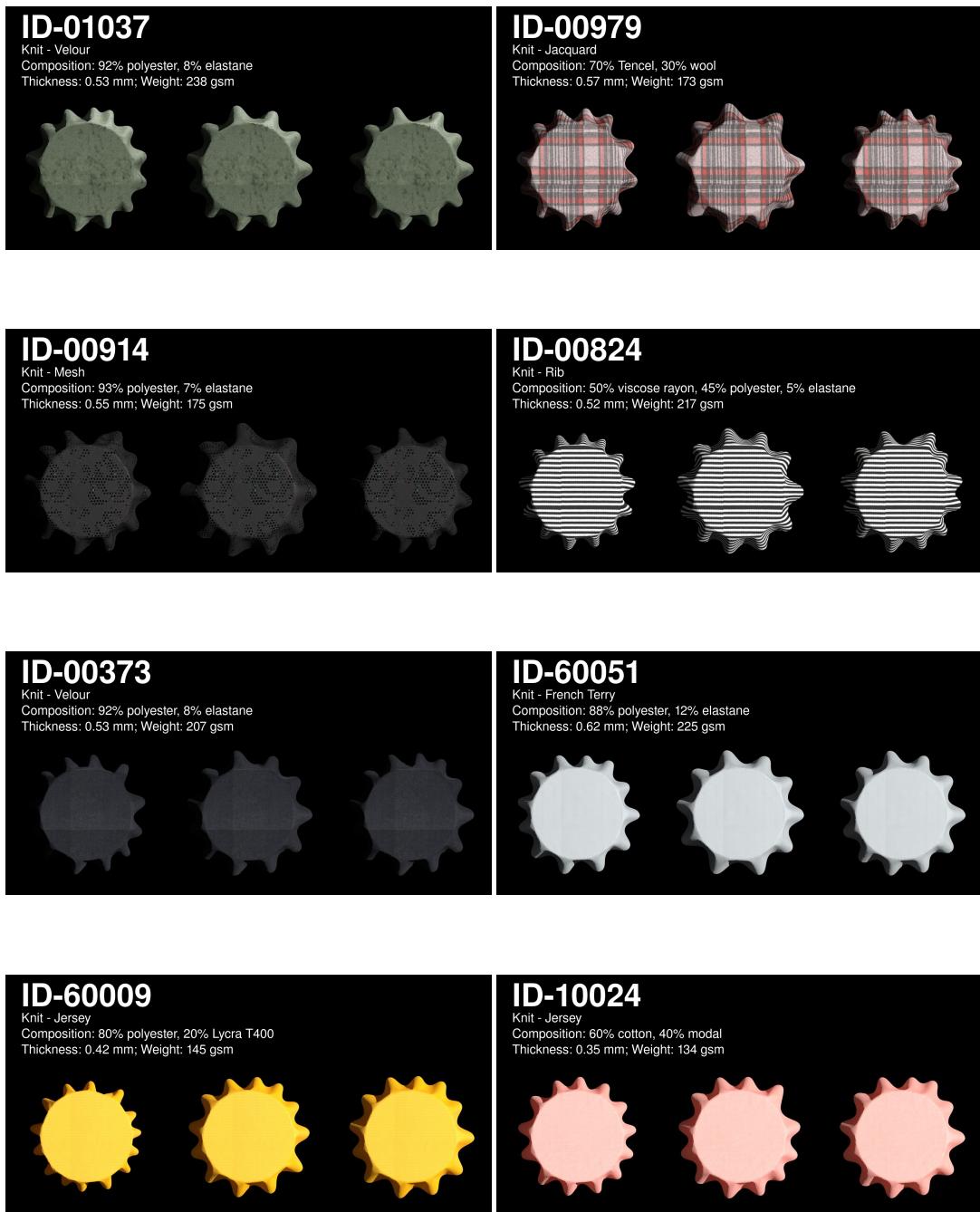
Knit - Jersey  
Composition: 92% polyester, 8% elastane  
Thickness: 0.31 mm; Weight: 123 gsm



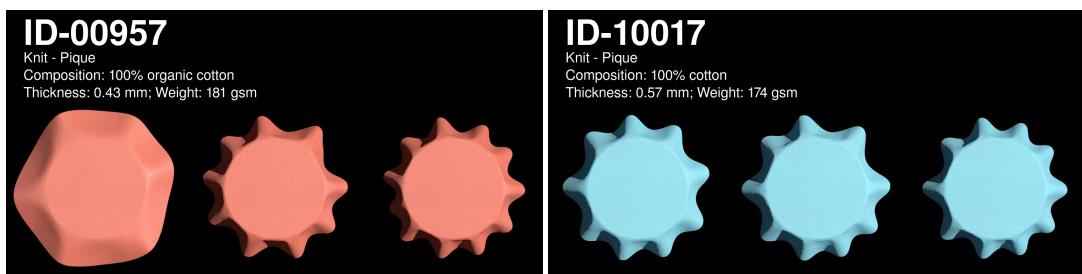
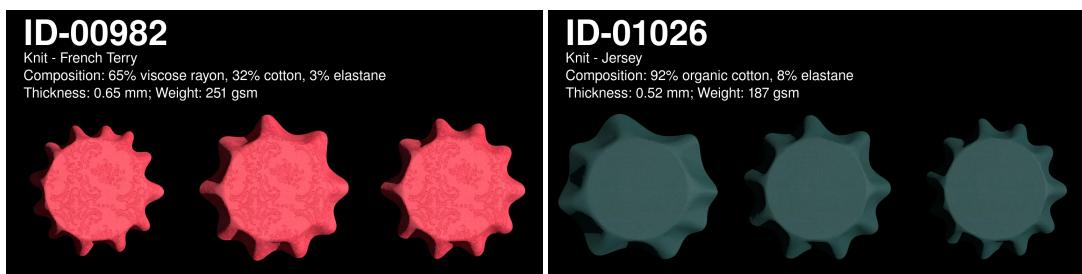
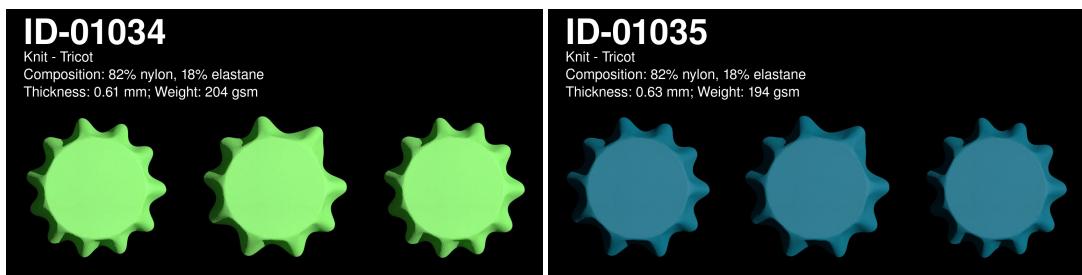
**ID-01046**

Knit - Jersey  
Composition: 90% nylon, 10% elastane  
Thickness: 0.36 mm; Weight: 151 gsm



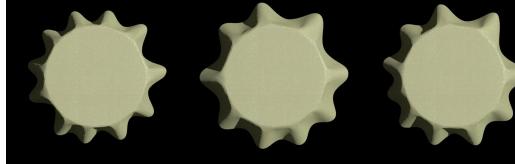






### ID-00958

Knit - Pique  
Composition: 100% cotton  
Thickness: 0.42 mm; Weight: 128 gsm



### ID-00931

Knit - Jacquard  
Composition: 66% cotton, 31% polyester, 3% elastane  
Thickness: 0.58 mm; Weight: 194 gsm



### ID-10037

Knit - Jersey  
Composition: 100% cotton  
Thickness: 0.51 mm; Weight: 146 gsm



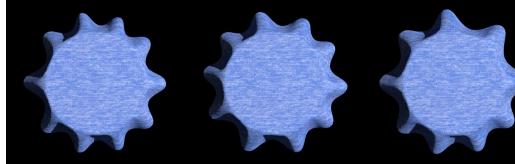
### ID-10006

Knit - Interlock  
Composition: 100% cotton  
Thickness: 0.49 mm; Weight: 147 gsm



### ID-00341

Knit - Brushed Back Fleece  
Composition: 94% nylon, 6% elastane  
Thickness: 0.63 mm; Weight: 230 gsm



### ID-00916

Knit - French Terry  
Composition: 50% cotton, 45% polyester, 5% elastane  
Thickness: 0.64 mm; Weight: 256 gsm



### ID-00978

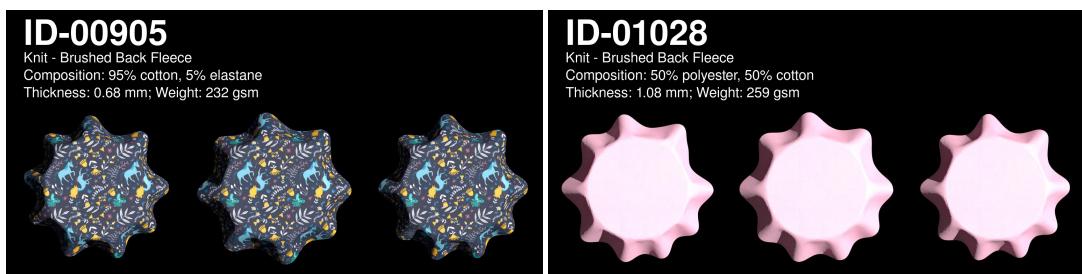
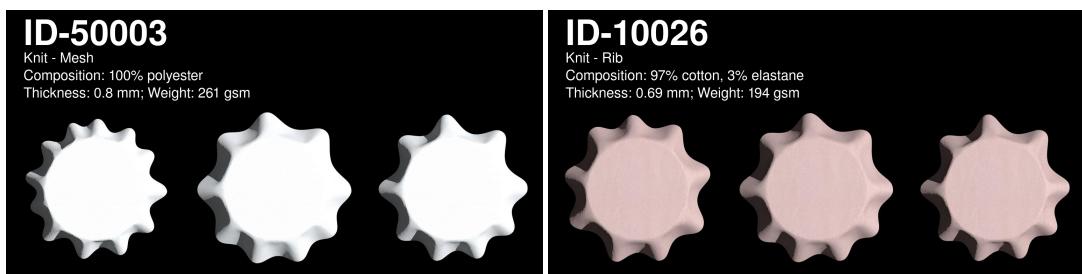
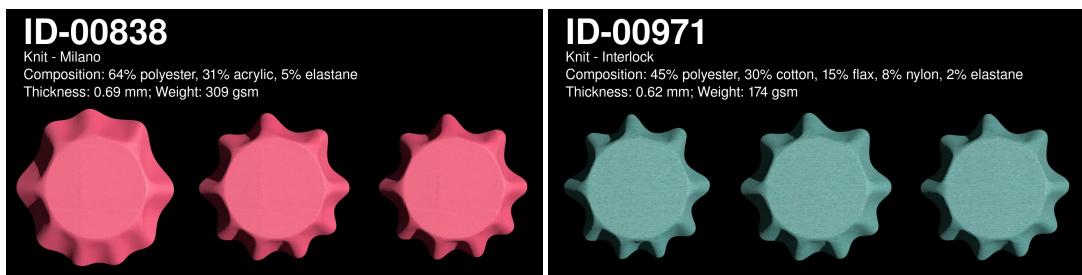
Knit - Interlock  
Composition: 100% cotton  
Thickness: 0.42 mm; Weight: 189 gsm



### ID-10004

Knit - Interlock  
Composition: 80% cotton, 20% wool  
Thickness: 0.64 mm; Weight: 200 gsm





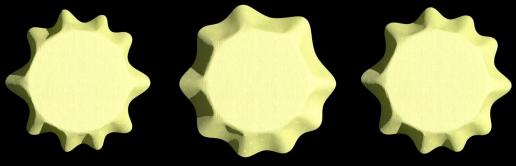
### ID-00919

Woven - Plain  
Composition: 100% viscose rayon  
Thickness: 0.2 mm; Weight: 99 gsm



### ID-00940

Woven - Plain  
Composition: 100% viscose rayon  
Thickness: 0.31 mm; Weight: 120 gsm



### ID-20006

Woven - Plain  
Composition: 88% polyester, 9% cotton, 3% elastane  
Thickness: 0.33 mm; Weight: 177 gsm



### ID-00975

Knit - Interlock  
Composition: 100% cotton  
Thickness: 0.31 mm; Weight: 81 gsm



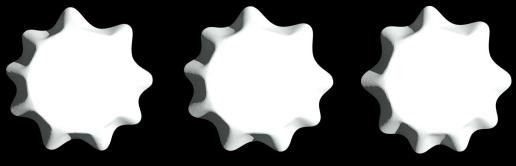
### ID-00974

Knit - Pique  
Composition: 100% cotton  
Thickness: 0.77 mm; Weight: 220 gsm



### ID-00966

Knit - French Terry  
Composition: 100% cotton  
Thickness: 1.04 mm; Weight: 316 gsm



### ID-00996

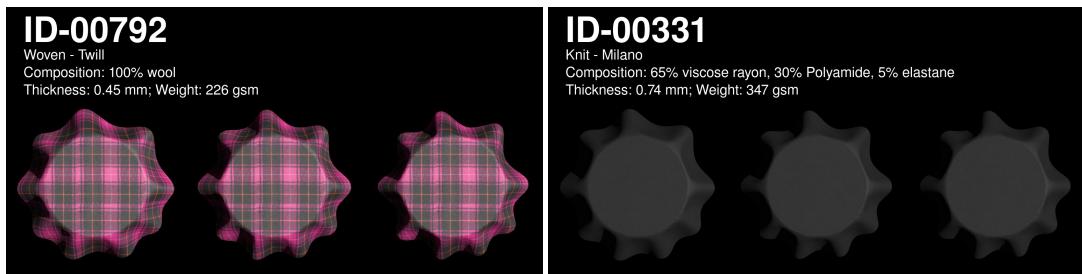
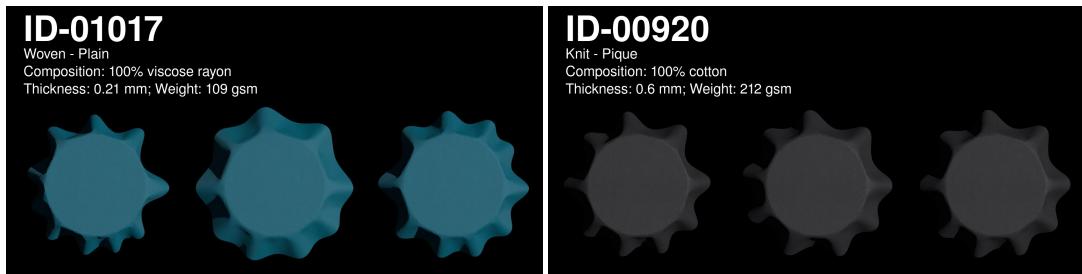
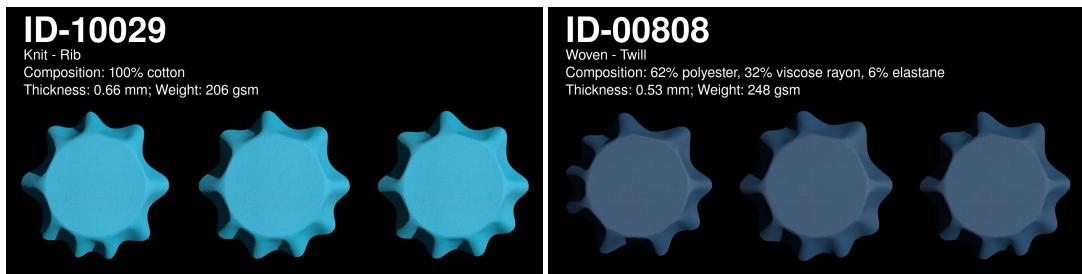
Woven - Plain  
Composition: 89% polyester, 11% elastane  
Thickness: 0.47 mm; Weight: 202 gsm

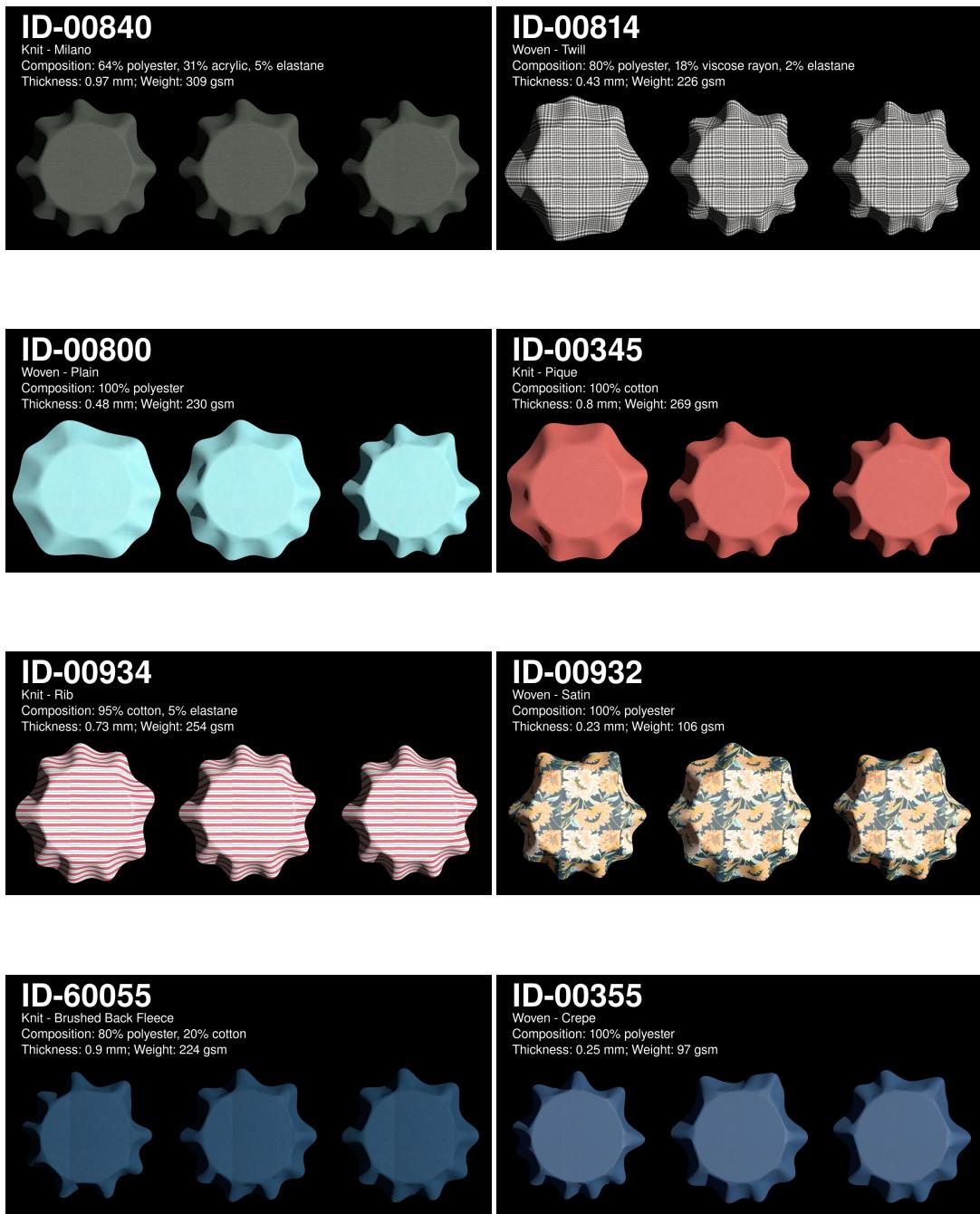


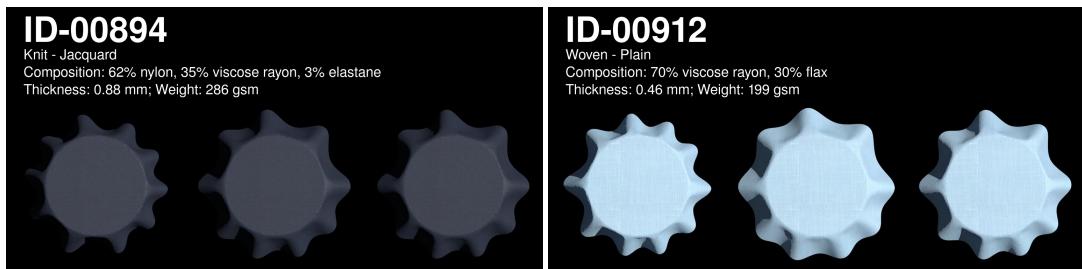
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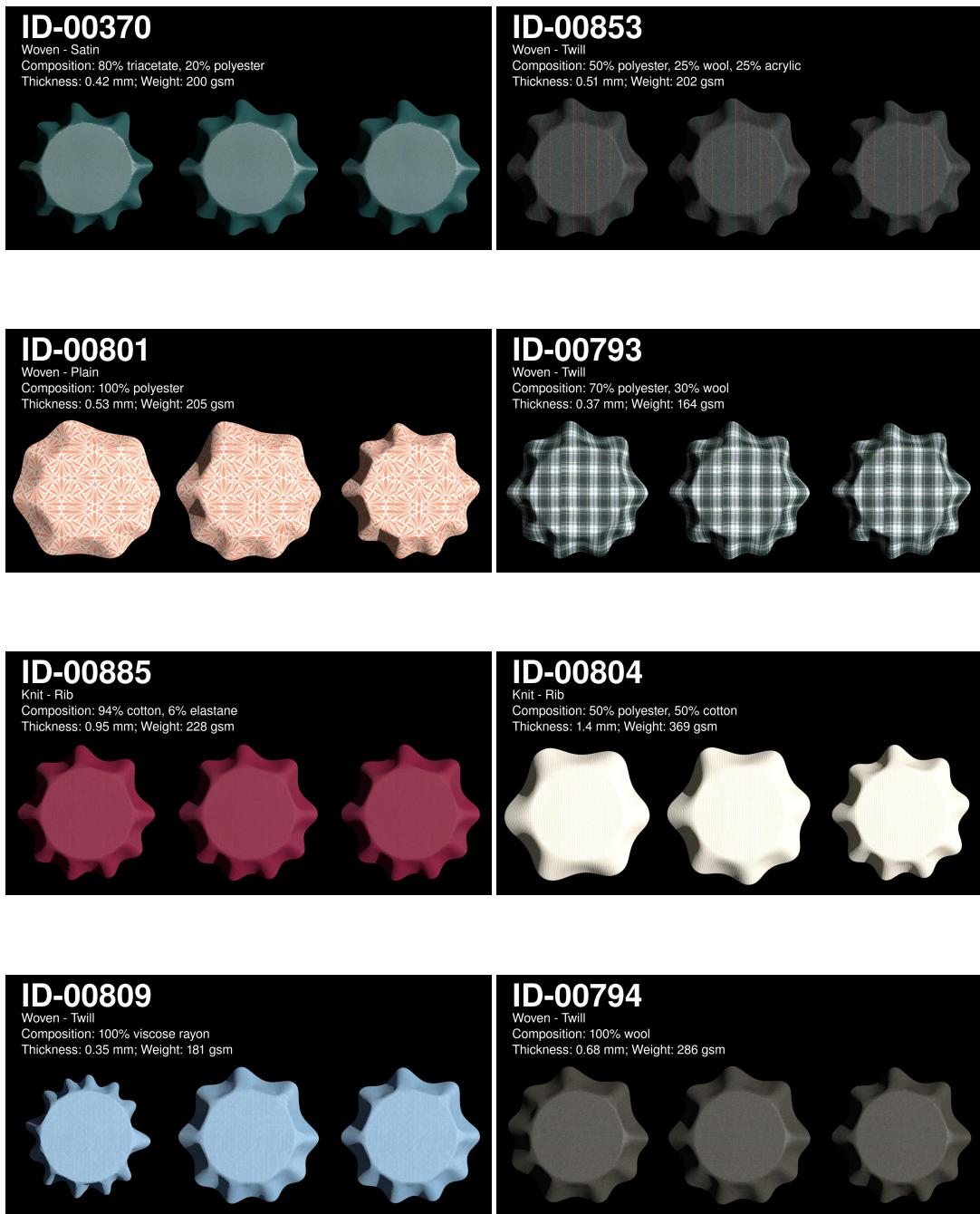
Woven - Crepe  
Composition: 100% viscose rayon  
Thickness: 0.38 mm; Weight: 116 gsm

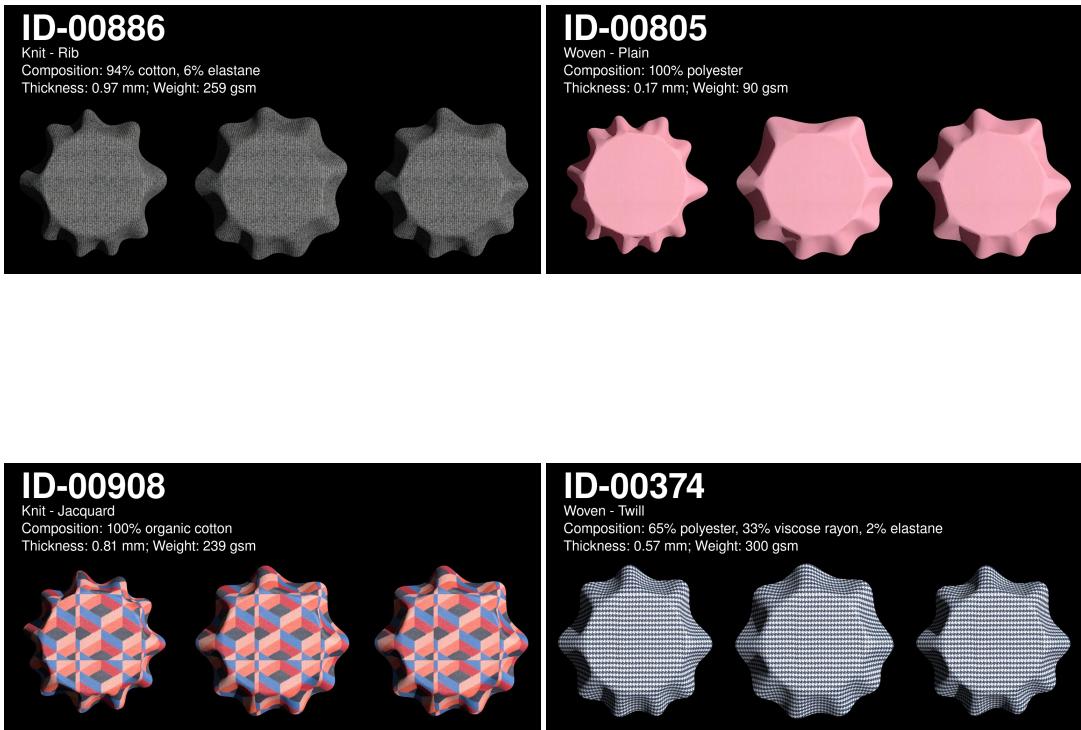












## References

- [HZRS15] HE K., ZHANG X., REN S., SUN J.: Deep residual learning for image recognition, 2015. [arXiv:1512.03385](https://arxiv.org/abs/1512.03385). 1