



University of *Ljubljana*  
Faculty of Natural Sciences and  
Engineering  
Slovenia



# Influence of different Illuminations on Colour Appearance of Mica Pigments printed on Synthetic Papers

Authors:

**Mirica Debeljak, Diana Gregor-Svetec**



# GOAL OF RESEARCH WORK

Influence of effect pigments on:

- *Flop index*
- *Haze index*
- *Print gloss*



# INTRODUCTION



## Mica Pigments

- play a dominant role in many applications
- change their appearance with viewing angle and lighting conditions
- produced by the deposition of metal oxide layers on the mica in aqueous suspension



## Mica Pigments

- $\text{TiO}_2$ -silver mica pigments (brilliant white) and interference mica pigments (dual colour)
- Iron oxide-high luster earth tones mica pigments
- $\text{TiO}_2/\text{FeO}_3$  or  $\text{TiO}_2/\text{CrO}_3$  gold or green mica pigments

# Mica Pigments

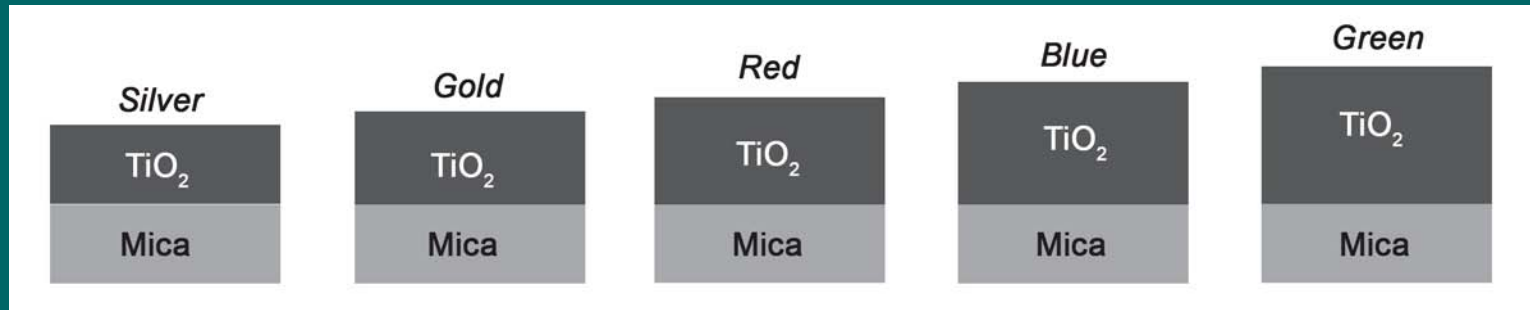


Fig.: TiO<sub>2</sub> - Mica Pigments

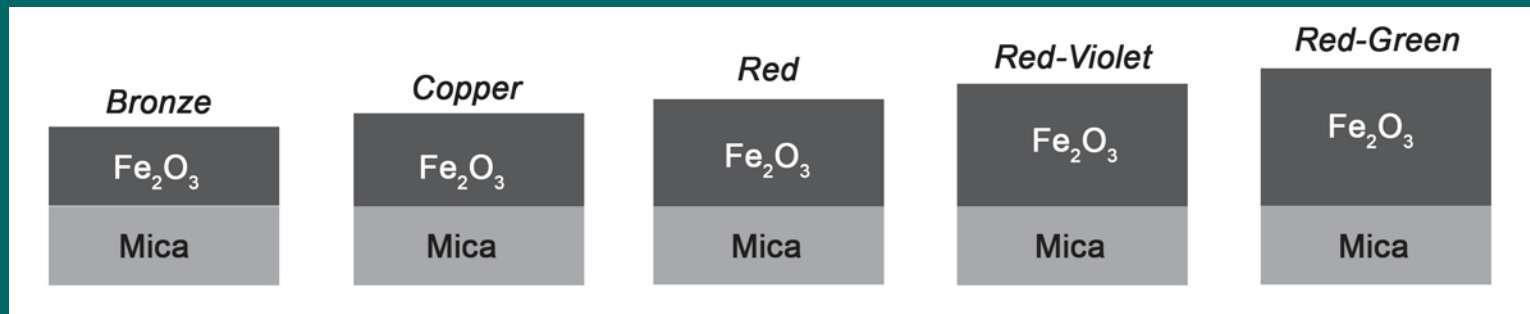


Fig.: Fe<sub>2</sub>O<sub>3</sub> - Mica Pigments



**EXPERIMENTAL**



## Materials:

- *Iriodin 325<sup>®</sup> Solar Gold*
- *Iriodin 119<sup>®</sup> Polar White*
- *Fiber synthetic paper Pretex*
- *Film synthetic paper Yupo*
- *Process offset inks (C, M, Y, K)*





# Evaluations

- *SEM analysis*
- *Flop index*
- *Haze index*
- *Print gloss*



# RESULTS



# Properties of Effect Pigments

Properties	Iriodin® 119 Polar White	Iriodin® 325 Solar Gold
Physical form	Dry, free-flowing powder	Dry, free-flowing powder
Composition	Mica, TiO <sub>2</sub> , SnO <sub>2</sub>	Mica + SiO <sub>2</sub> , TiO <sub>2</sub> , Fe <sub>2</sub> O <sub>3</sub> , SnO <sub>2</sub>
Colour	Silverwhite	Gold
Particle size	5 - 25 µm	5 - 25 µm
pH - value	8 - 11	5 - 10

# SEM images of Effect Pigments

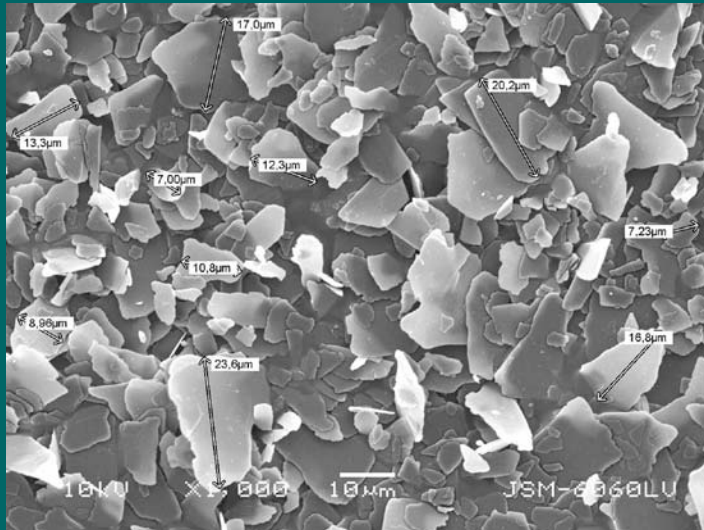


Fig.: Iriodin 119<sup>®</sup> Polar White.

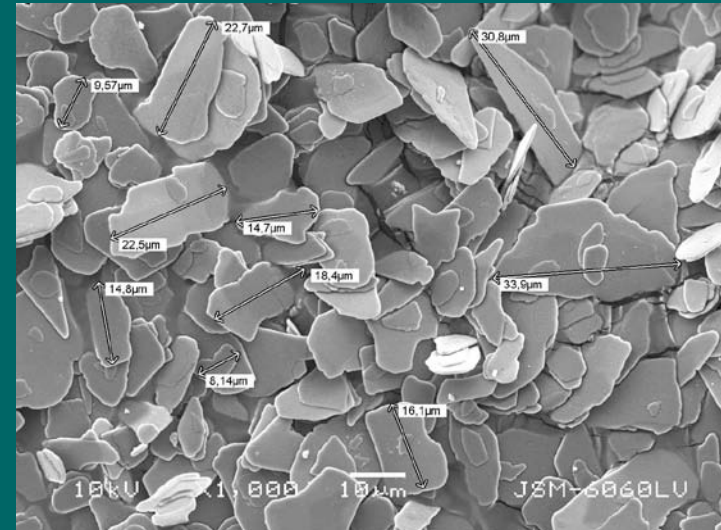


Fig.: Iriodin 325<sup>®</sup> Solar Gold.



# Properties of Synthetic Papers

Properties	Paper Yupo	Paper Pretex
Grammage (g/m <sup>2</sup> )	100	100
CIE Whiteness	90	82
Roughness, PPS [μm]	1,2	3,83
Gloss at 75 ° [%]	53	27



# Flop Index of Effect Pigments

Flip-flop effect is quantified by flop-index. A flop index (F) was derived as a function of the CIELAB  $L^*$  measured at three angles in order to quantify an appearance attribute:

$$F=2.69*(a/b)$$

$$a=[L^*(15^\circ)-L^*(110^\circ)]^{1.11}$$

$$b=[L^*(45^\circ)]^{0.86}$$

## Flop Index of Effect Pigments printed on Paper Yupo

Pigments/ Illuminants		Flop index		
		D50	A	F11
Iriodin 119	C	4,50	5,23	5,04
	M	5,08	4,19	4,59
	Y	1,92	1,84	1,84
	K	16,63	16,51	16,61
Iriodin 325	C	4,63	5,45	5,11
	M	5,34	4,51	4,89
	Y	2,11	2,07	2,08
	K	16,96	16,79	16,94

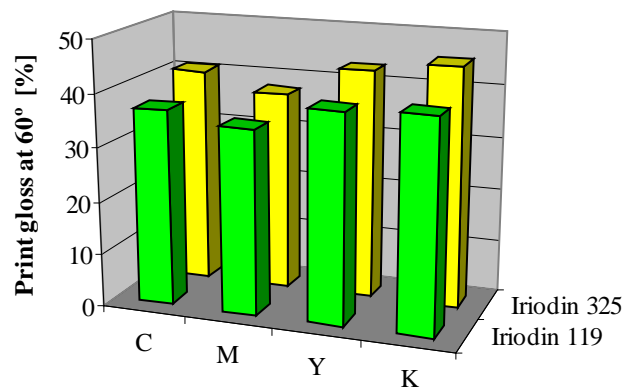
## Flop Index of Effect Pigments printed on Paper Pretex

Pigments / Illuminants		Flop index		
		D50	A	F11
Iriodin 119	C	3,43	4,02	3,81
	M	4,31	3,57	3,89
	Y	1,34	1,28	1,29
	K	12,07	11,94	12,03
Iriodin 325	C	4,48	5,20	4,88
	M	5,49	4,68	5,05
	Y	2,08	2,02	2,03
	K	12,75	12,63	12,72

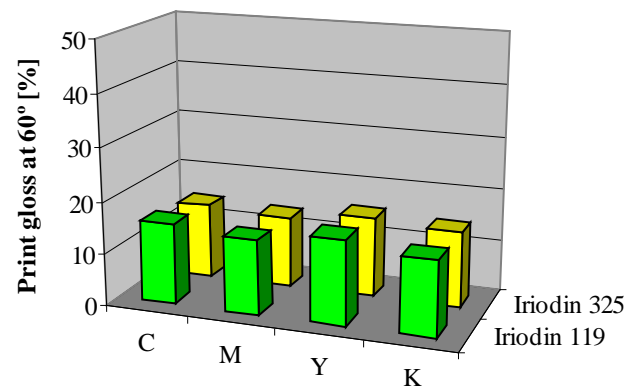


# Print Gloss of Effect Pigments

Paper Yupo



Paper Pretex





# Haze Index of Effect Pigments

Haze index (H) is useful for evaluating the haze in clear finishes on non-glossy substrates and in reflected images on opaque glossy pigmented finishes. The formula for haze index is:

$$H=R60-R20$$

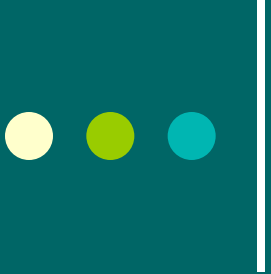
# Haze Index of Effect Pigments

Pigments	Haze index (Yupo)			
	C	M	Y	K
Iriodin 119	29,40	27,93	30,83	31,13
Iriodin 325	30,33	29,40	32,47	33,83

Pigments	Haze index (Pretex)			
	C	M	Y	K
Iriodin 119	13,07	12,07	13,23	12,47
Iriodin 325	12,00	11,40	12,30	12,27



# CONCLUSION

- 
- the highest flop index for both pigments was obtained at black background
  - at D50 illuminant the flop index was the highest, at illuminant A the lowest
  - the highest print gloss, especially when overpainted by gold pigment Iriodin 325 and also the haze index was the highest at paper Yupo



# CONTACT

PhD. **Diana Gregor Svetec**

e-mail: [diana.gregor@ntf.uni-lj.si](mailto:diana.gregor@ntf.uni-lj.si)

**Mirica Debeljak**, B. Sc.

e-mail: [mirica.debeljak@ntf.uni-lj.si](mailto:mirica.debeljak@ntf.uni-lj.si)



**Thank you for  
your attention!**