An innovative concealing technology designed to enhance the beauty of every skin tone with a natural look and high coverage

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Background

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Issues

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Requirements

Background

Issues

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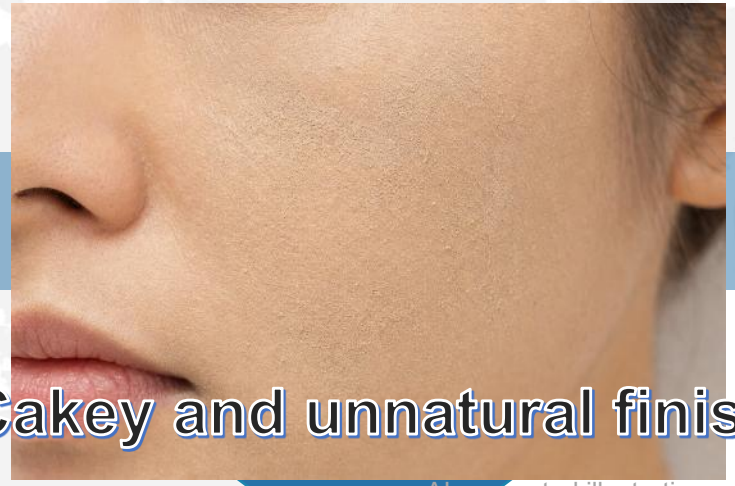

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Requirements

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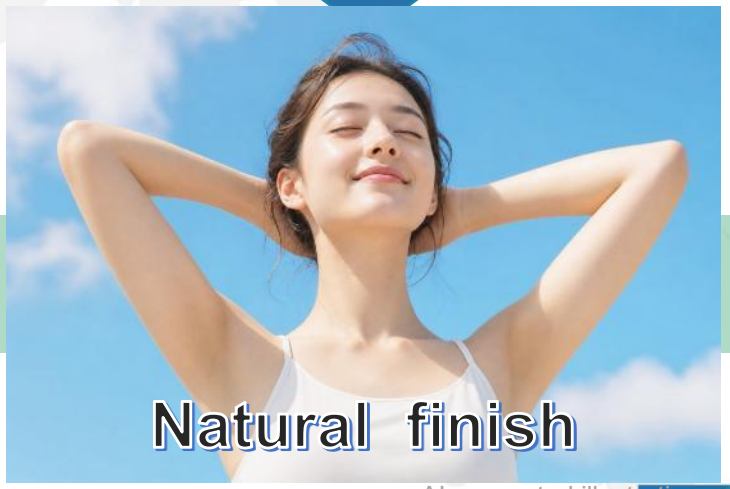

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Aim of this study

To develop a concealing technology that provides both high coverage and a natural finish

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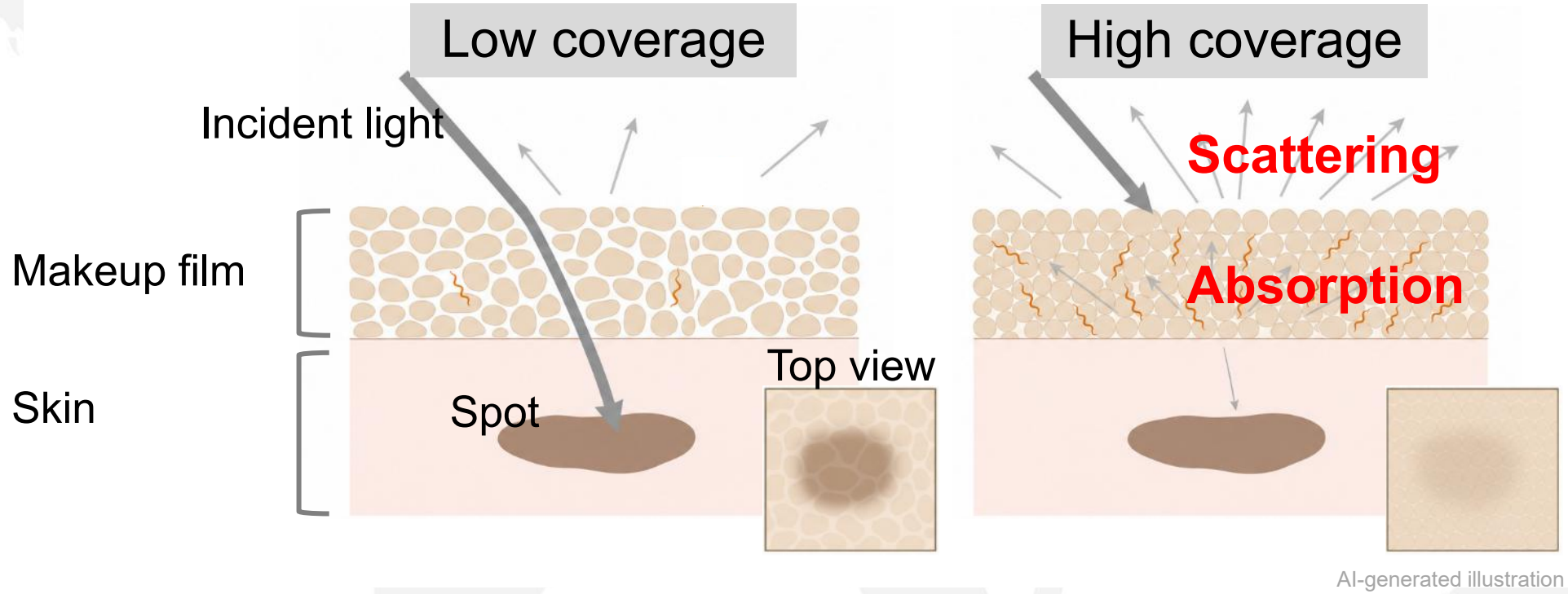
Across all skin tones

Outlines

1. Challenges with conventional technology
2. Material design
3. Properties of developed material
4. Performance on skin and shade expansion

What Is High Coverage?

High coverage means effectively hiding underlying skin imperfections.



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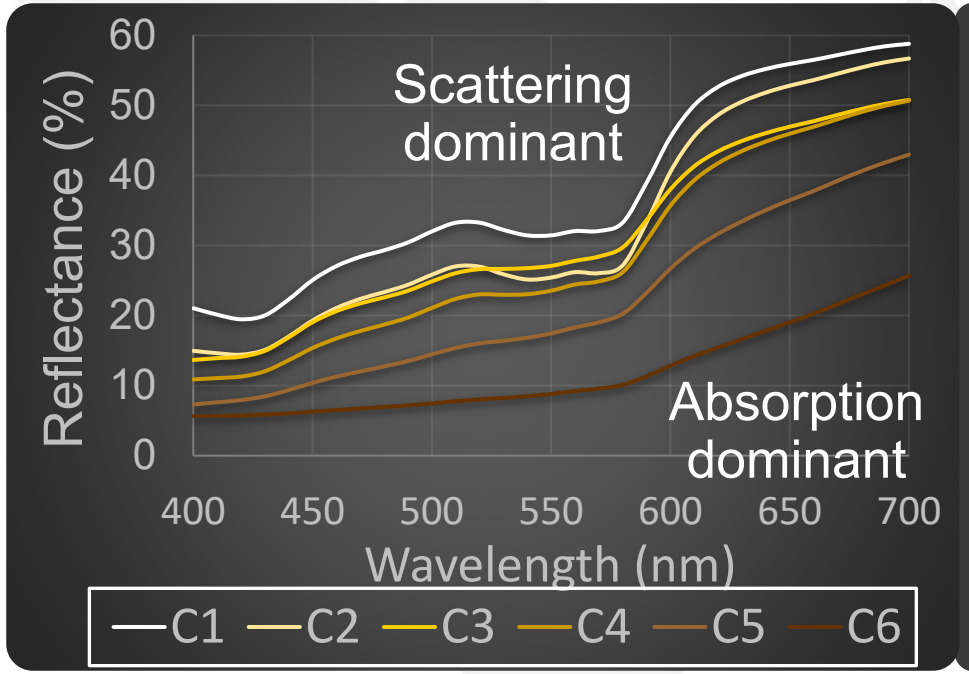
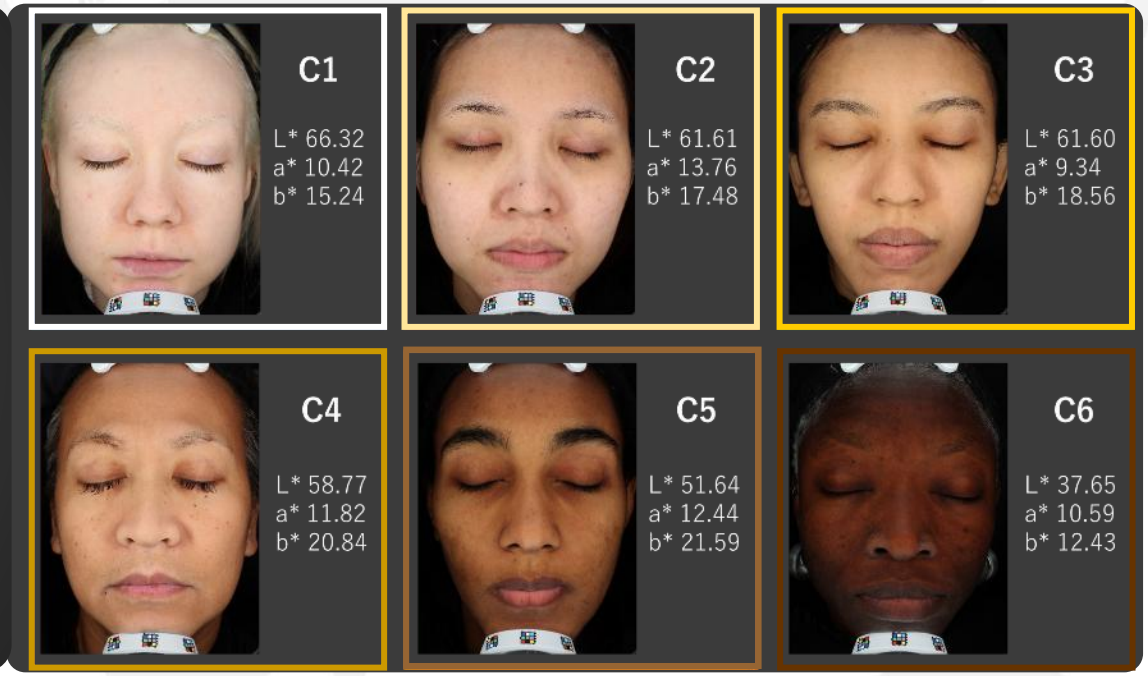
Both scattering and absorption contribute to coverage

What Is a Natural Finish?

A natural finish means reproducing the optical appearance of skin.





The ideal reflectance profile differs depending on skin tone.

Kakimoto R., Discovery of global common denominators of skin reflectance that enhance attractive impressions., IFSCC Congress Podium Communications, Lecture #39, (2022)

How Are Concealing Formulations Designed?

The optical balance is controlled primarily by titanium dioxide and iron oxides.

For lighter skin

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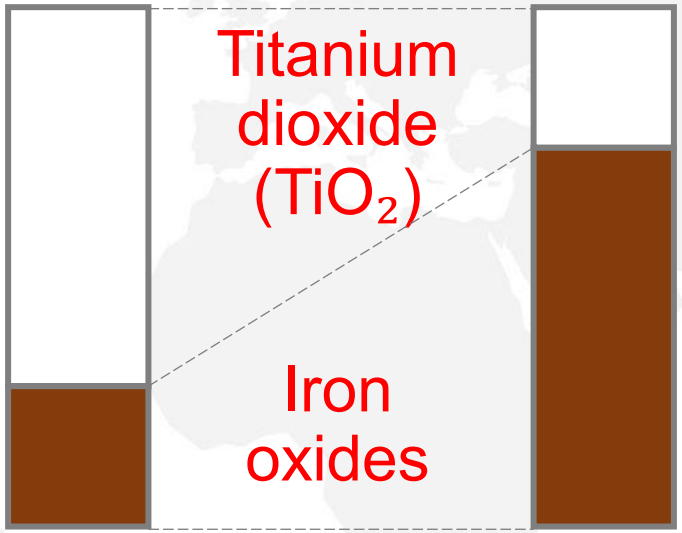
Primarily by light scattering

→ Highly efficient coverage



For darker skin

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Primarily by light absorption

→ Less efficient coverage

Achieving high coverage becomes increasingly difficult in darker skin

Key Challenges in Darker Skin Concealers

How can we achieve both high coverage and a natural finish in darker skin?

Challenge 1

TiO_2 causes white cast

Challenge 2

Iron oxide aggregation

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A new strategy is required to achieve both goals

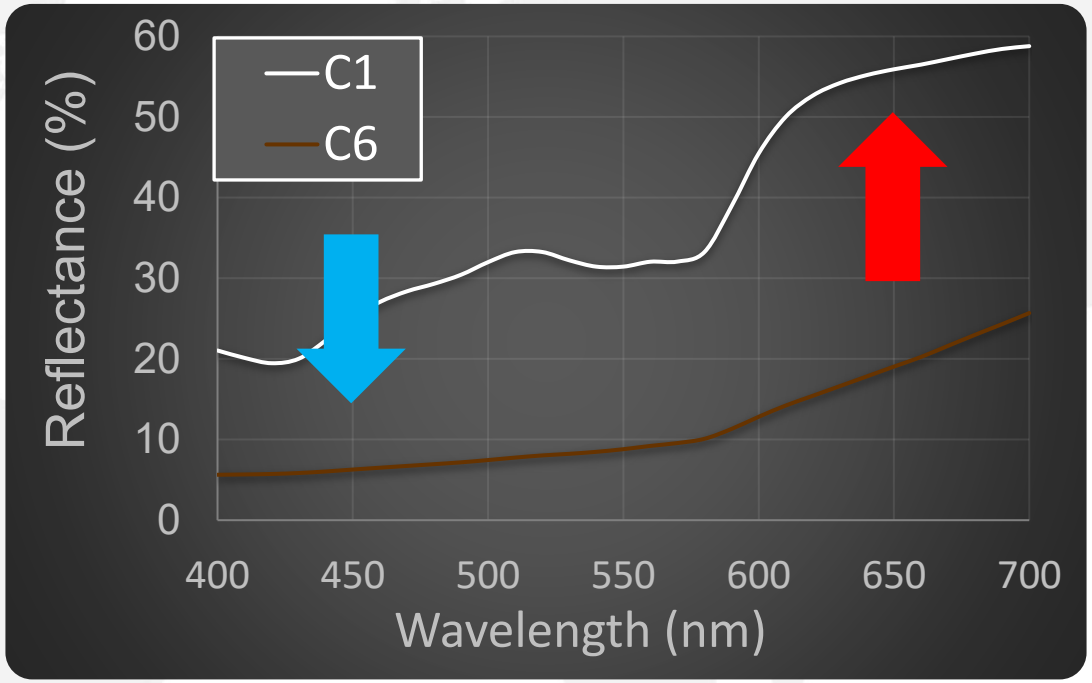
Challenge 1: TiO_2 Causes White Cast

Although TiO_2 is indispensable for coverage, its optical properties are not always ideal for darker skin.

Excessive scattering may cause white cast

↓

Larger particles may moderate scattering intensity



Excessive blue reflection

↓

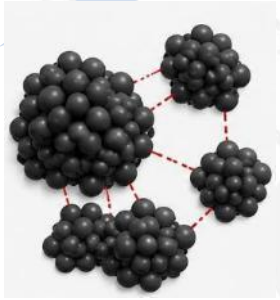
Larger particles may shift the reflectance profile

Hypothesis: Large-particle TiO_2 may better match darker skin tones

Challenge 2: Iron Oxide Aggregation

The dispersion state of iron oxides strongly affects coverage.

1. Initial aggregates
2. After dispersion
3. Re-aggregation



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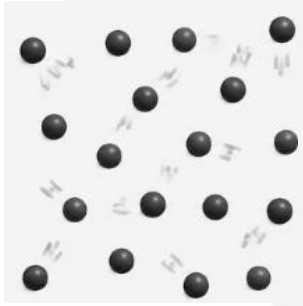

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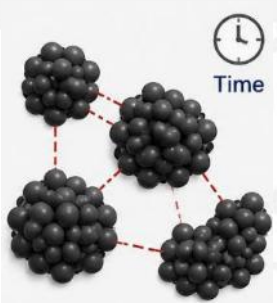

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Both improved dispersion and suppression of re-aggregation are essential for high coverage.

Outlines

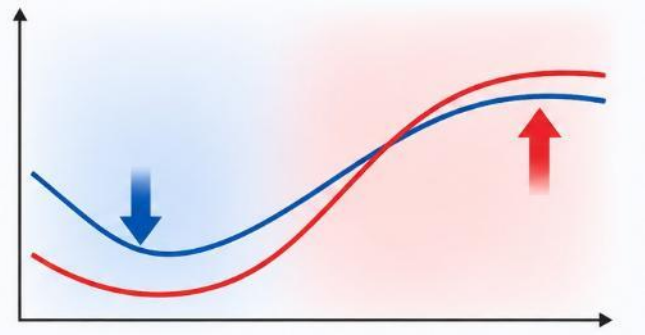
1. Challenges with conventional technology
2. **Material design**
3. Properties of developed material
4. Performance on skin and shade expansion

Requirements for an Ideal Concealer

For a natural finish

- Reduced short-wavelength(Blue) reflection
- Enhanced long-wavelength(Red) reflection

  ⇒large TiO_2



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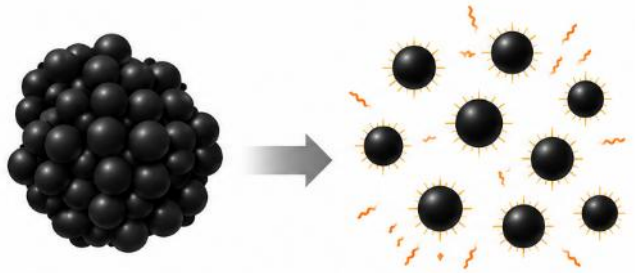
For high coverage

- Effective utilization of TiO_2
- Improved dispersion of iron oxides
- Suppression of re-aggregation of iron oxides

  ⇒How to…?



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How Can Iron Oxide Dispersion Be Improved?

Several approaches have been proposed to improve iron oxide dispersion.

- Dispersants
  - ⇒ May reduce long-lasting performance
- Surface-treated pigments
  - ⇒ Often classified as SPM, limiting broad applicability
    *SPM: Synthetic Polymer Microparticles
- Mechanical force
  - ⇒ Broadly applicable without additional ingredients

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- ☑ Mechanical force
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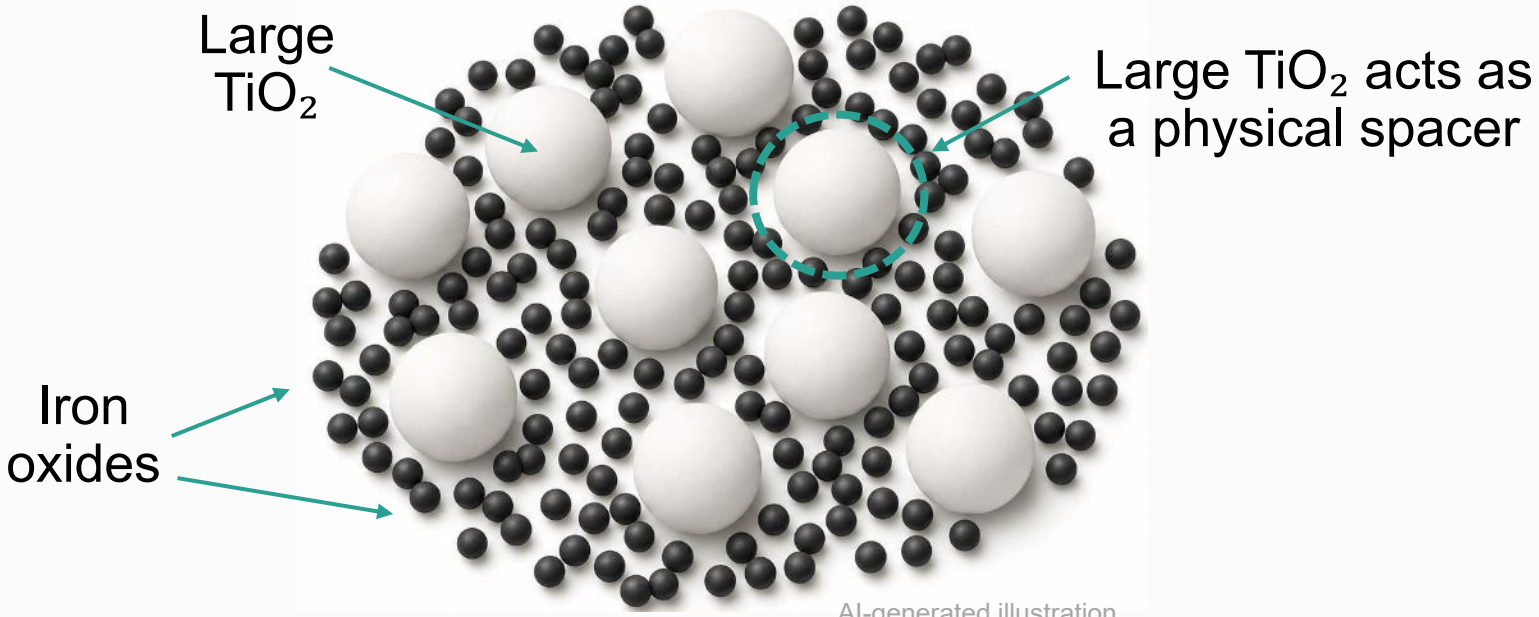
We found inspiration in the bead-milling process

Material Design

A novel material design for high coverage and a natural finish

IOLTD

(*Iron Oxide mixed with Large-particle Titanium Dioxide*)



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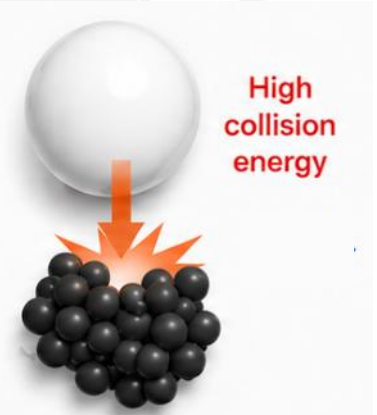
Manufacturing of IOLTD

Dry milling was performed at 40 m/s for 10 minutes using a tabletop mixer, providing higher collision energy than conventional mixing.

	IOLTD-1	IOLTD-2	IOLTD-3
Titanium dioxide	20% (1000 nm)	20% (700 nm)	20% (400 nm)
Black iron oxide	39%	39%	39%
Red iron oxide	33%	33%	33%
Yellow iron oxide	8%	8%	8%



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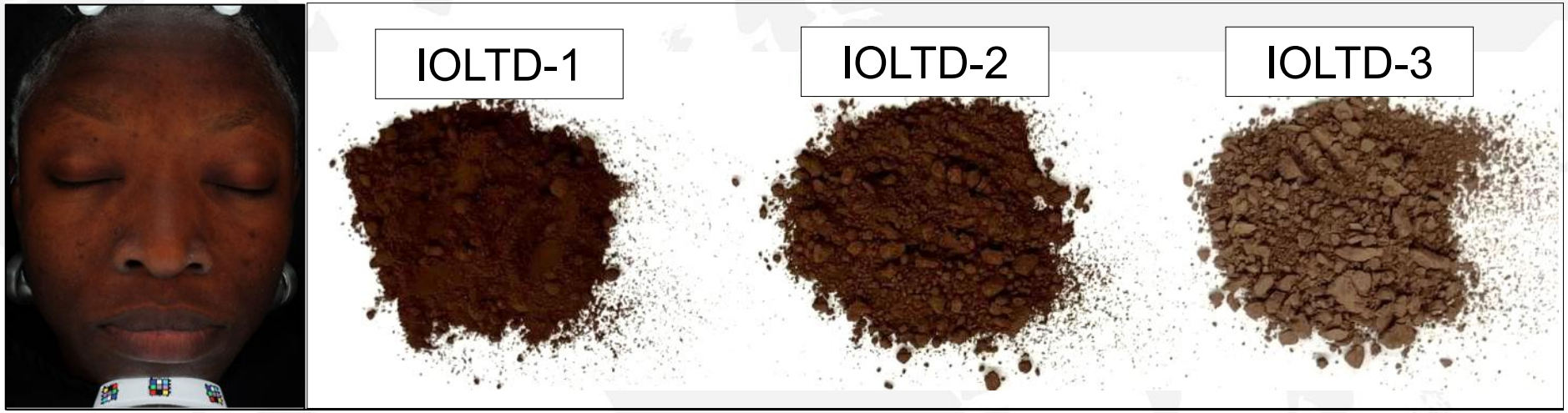
The effect of TiO_2 particle size on skin tone matching was evaluated.

Effect of TiO_2 Particle Size on Skin Tone Matching

TiO_2 particle size	1000 nm	700 nm	400 nm



	Darker skin tone	IOLTD-1	IOLTD-2	IOLTD-3
L*	37.65	38.09	38.66	43.30
Hue (°)	49.57°	47.77°	47.50°	47.17°

Larger TiO_2 particles showed lower lightness and higher hue, and IOLTD-1 best matched the darker skin tone.

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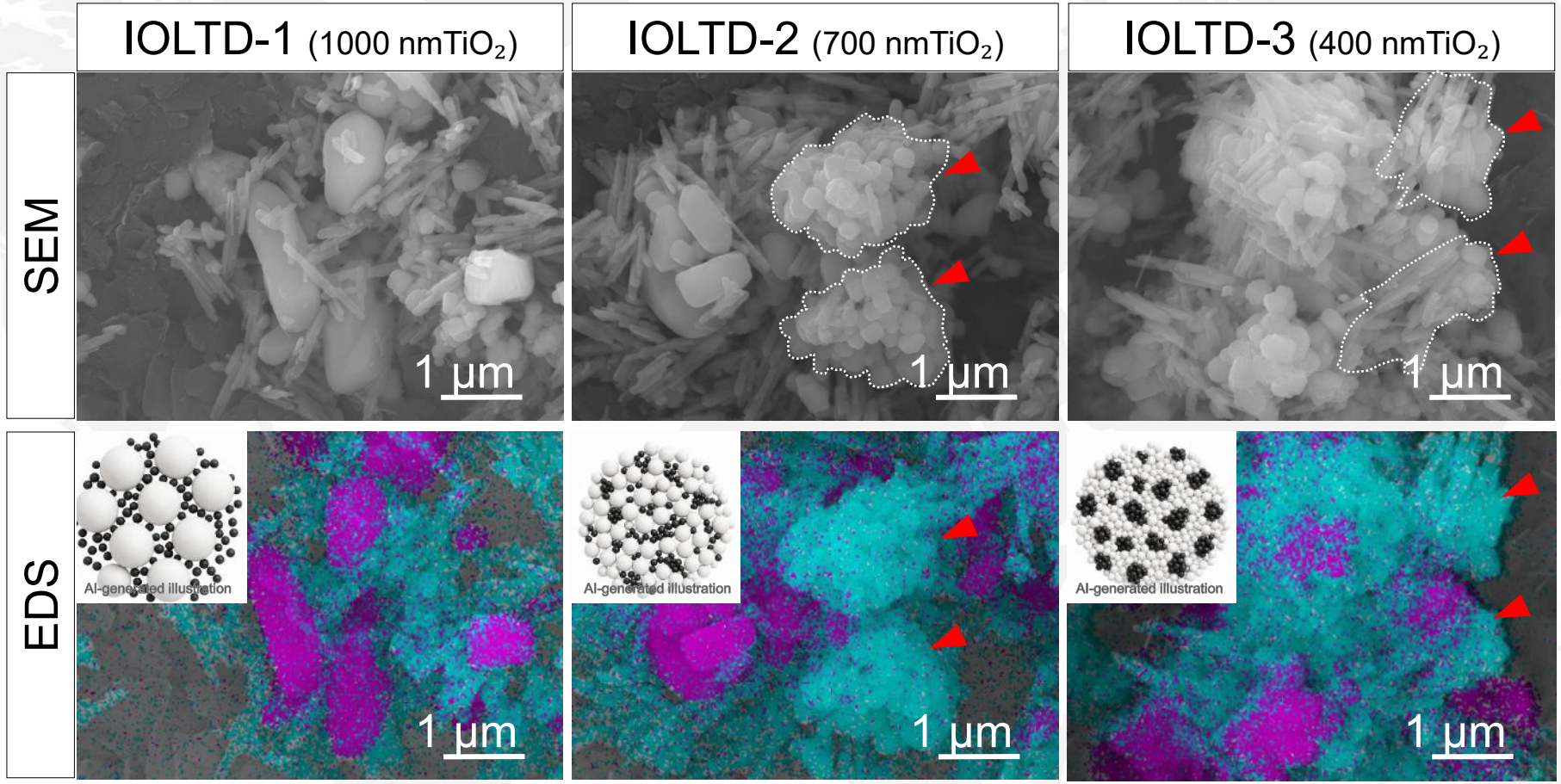
Structural Analysis of IOLTD by SEM-EDS



IOLTD-1 showed more uniform dispersion with reduced iron oxide aggregation.

Coverage Evaluation of Concealers Containing IOLTD

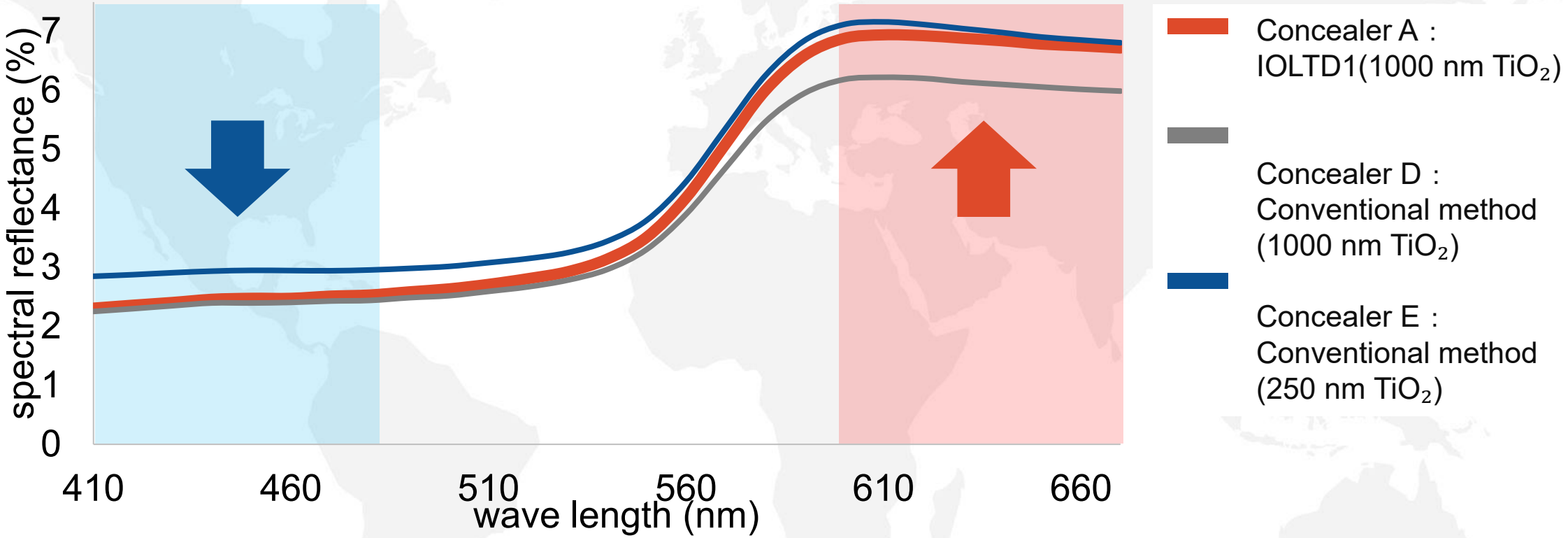
Wax-based concealers A–E were prepared.

	Concealer A	Concealer B	Concealer C	Concealer D	Concealer E
IOLTD	IOLTD-1	IOLTD-2	IOLTD-3	-	-
TiO_2	-	-	-	1000 nm	250 nm
Iron oxide	-	-	-	IOLTD equivalent	
Mixing Method	IOLTD method			conventional method	

Coverage and optical properties were compared under equivalent pigment compositions.

Spectral reflectance property

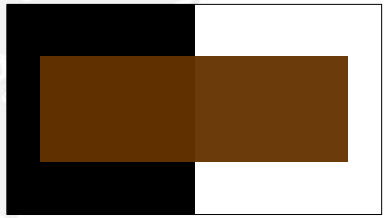
Spectral reflectance was measured using a spectrophotometer.



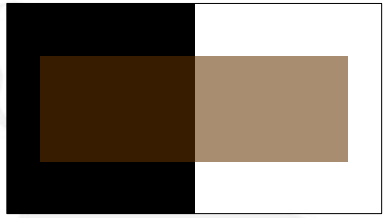
Concealer A showed lower blue light reflectance and higher red light reflectance than conventional formulations.

Coverage of Concealer Containing IOLTD

L*black / L*white value was calculated as coverage(%).



○ High coverage



× Low coverage

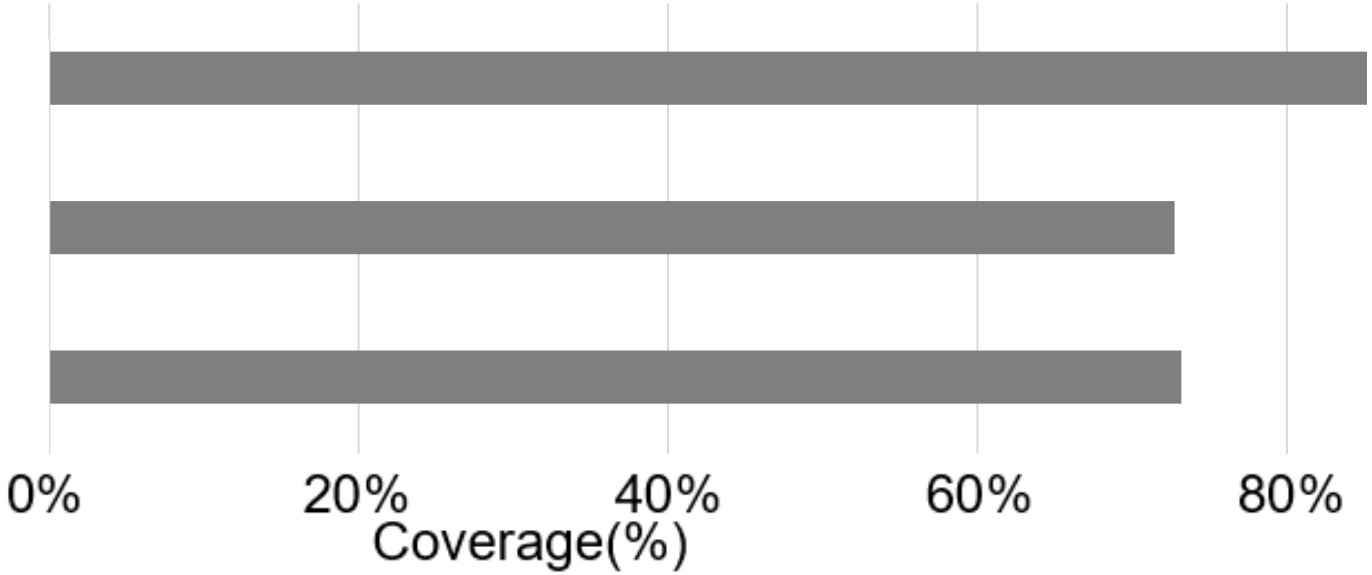
Smaller color differences indicate higher coverage

Coverage Evaluation of Concealers

Concealer A
: IOLTD1 (1000 nm TiO_2)

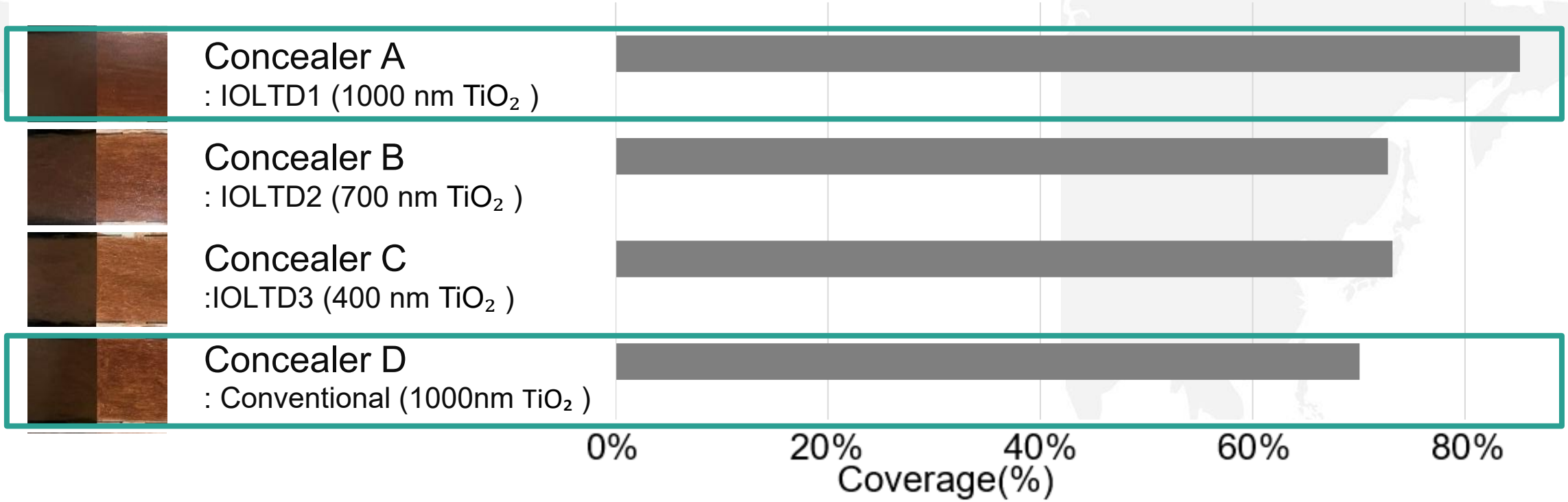
Concealer B
: IOLTD2 (700 nm TiO_2)

Concealer C
:IOLTD3 (400 nm TiO_2)



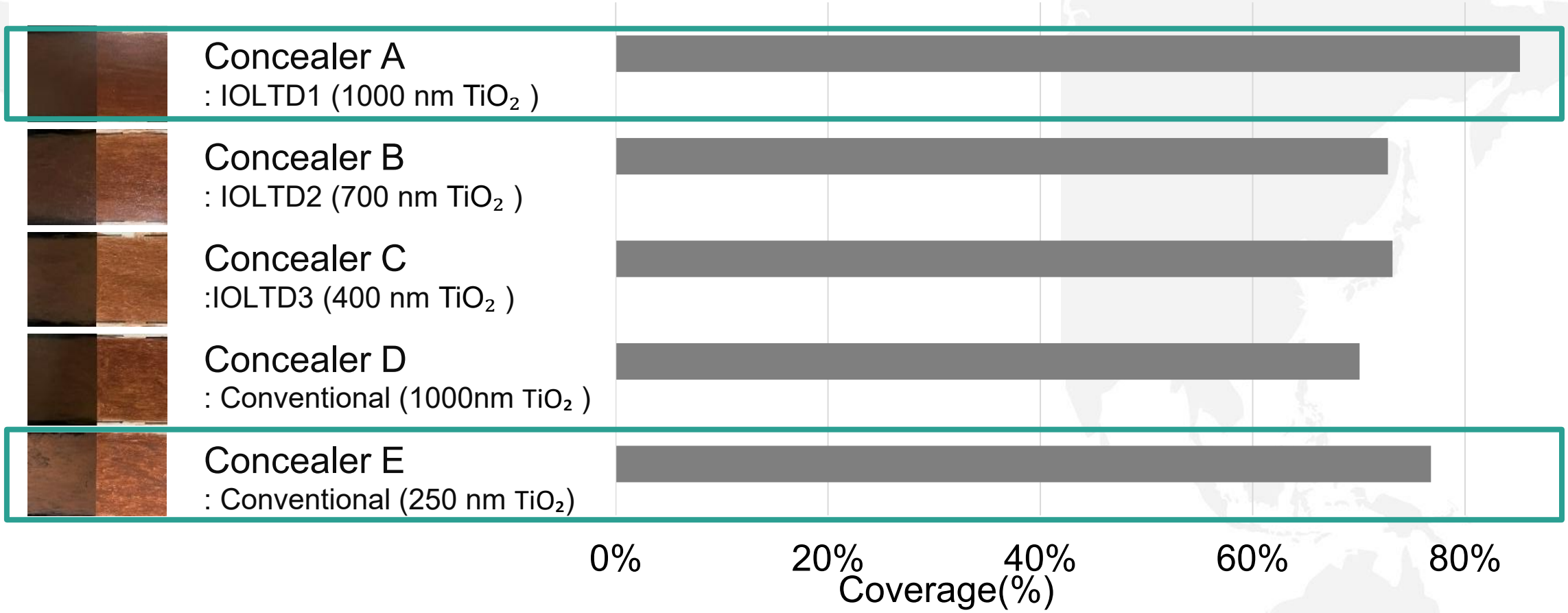
IOLTD-1 showed the highest coverage among the IOLTD formulations

Coverage Evaluation of Concealers



The IOLTD structure improved coverage with the same ingredients, pigment ratio, and 1000 nm TiO_2

Coverage Evaluation of Concealers



IOLTD-1 achieved high coverage and a natural finish through optical and dispersion control

Outlines

1. Challenges with conventional technology
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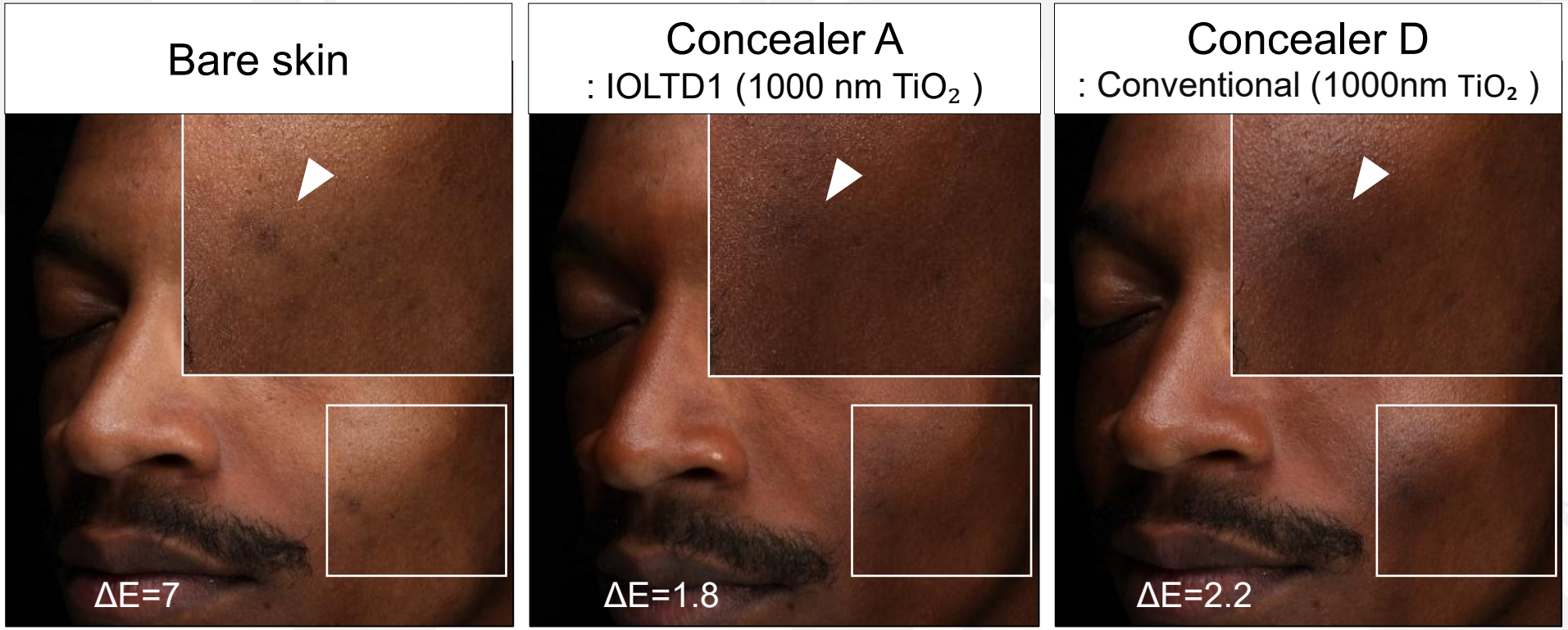
4. **Performance on skin and shade expansion**

Evaluation of Concealer on Darker Skin

Reduced color difference between spots and surrounding skin after concealer application



Concealer A achieved both high coverage and a natural finish on darker skin

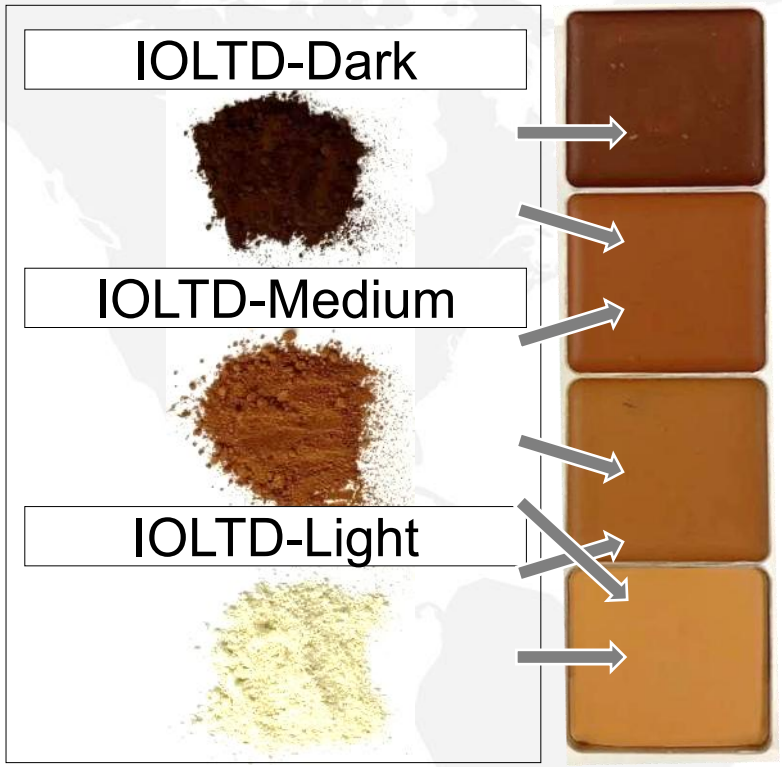
Inclusive Expansion Across All Skin Tones

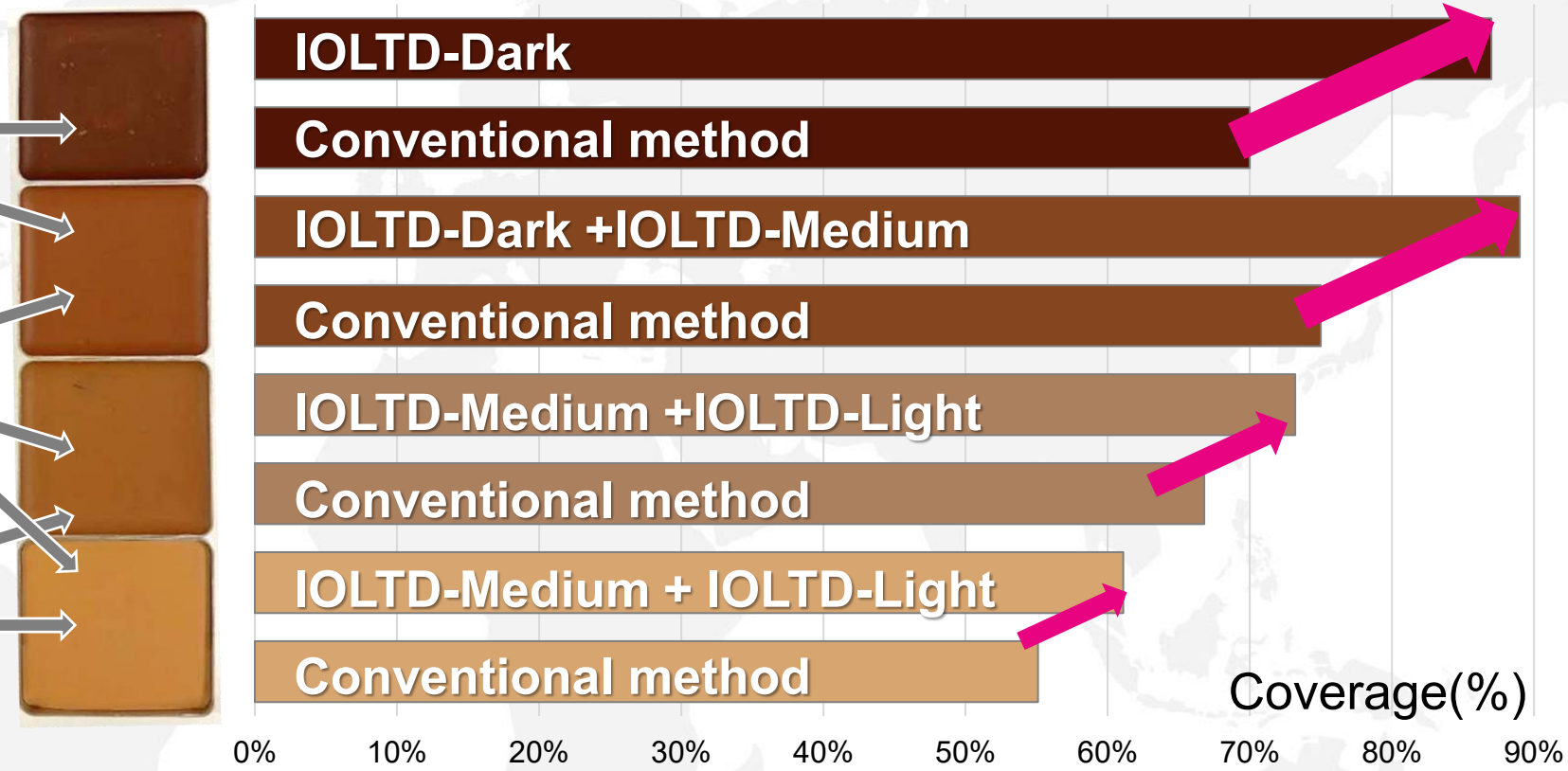
IOLTD concealers were prepared by varying the iron oxide composition

	IOLTD-Dark	IOLTD-Medium	IOLTD-Light
Titanium dioxide	20% (1000 nm)	34% (1000 nm)	99% (1000 nm)
Black iron oxide	39%	4%	0%
Red iron oxide	33%	25%	1%
Yellow iron oxide	8%	35%	0%

IOLTD enabled shade expansion for a wide range of skin tones

Inclusive Expansion Across All Skin Tones

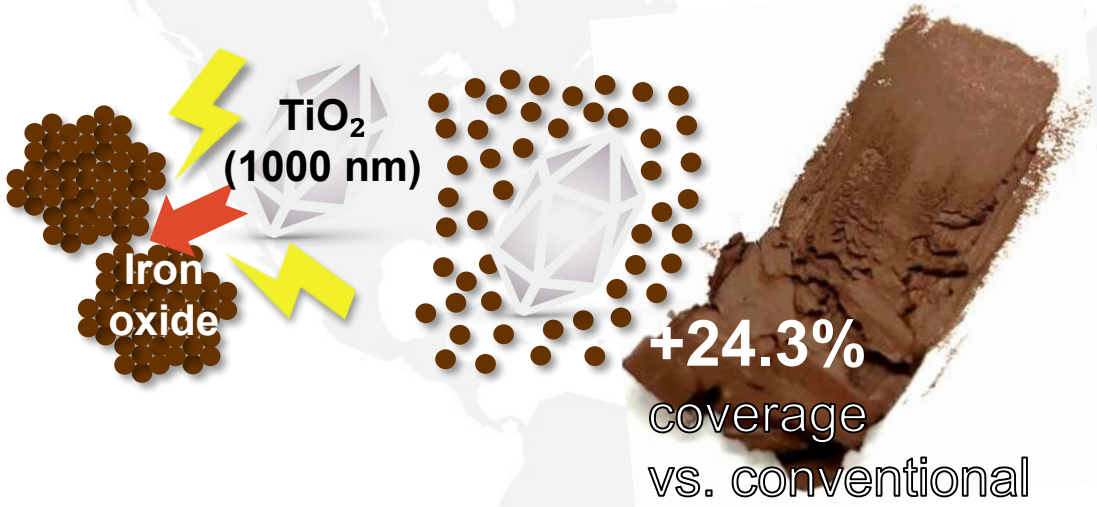




By adjusting composition, we produced IOLTD with high coverage across a wide range of skin tones.

Conclusion

Improving Iron Oxide Dispersion via TiO_2 Size Control



A groundbreaking concealing innovation for darker skin

Conclusion

IOLTD is a high-impact, future-ready technology with broad applicability

Adaptable to Various Skin Tones

Broad Potential Beyond Concealers

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Thank you for your attention