

Zircon Use in Ceramics – Emergent Trends



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Zircon Use in Ceramics – Emergent Trends

- Iluka's annual ceramic tile study
 - methodology
 - 2014 study results
- Emergent ceramic tile trends
 - digital printing
 - digital glazes
 - large-format and thin tiles
- Comparison of zircon versus alumina
- Conclusion

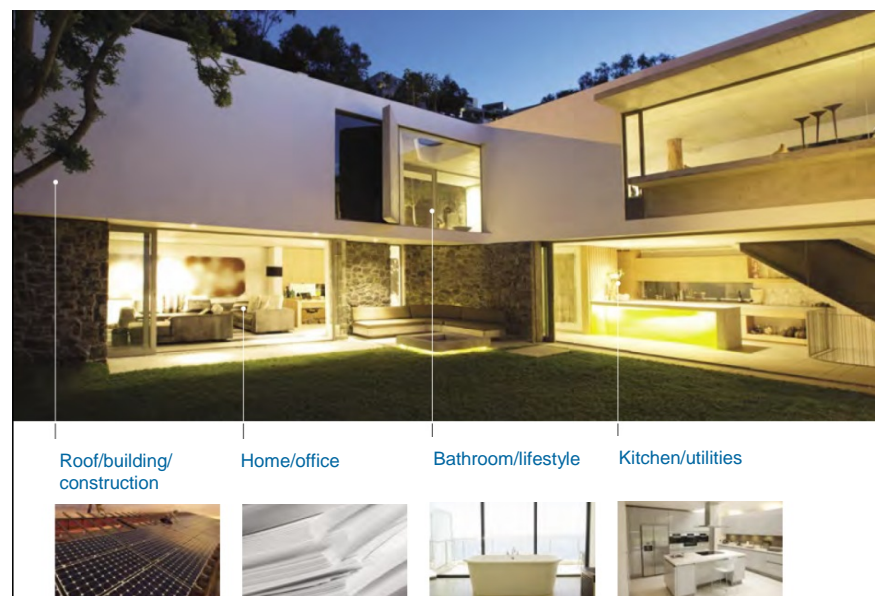
Iluka's annual tile study

Ceramics industry characteristics

- Massive, fragmented, dynamic
- Consumes ~50% of zircon globally
- Wide variety of tile types, designs
- Innovation a constant
- Difficult to gain insights into zircon intensity of use

Iluka's approach

- Measure zircon intensity of use towards the end of the value chain
- Obtain popular tiles from many regions and analyse for zircon content
- Track changes over time, monitor trends
- Proprietary study - third study was completed in 2014, some results released in February 2015



Tile study methodology

REGION-SPECIFIC

Features of regional production considered

MULTIPLE CONTACT POINTS

Industry reports, field interviews across industry supply chain & network, phone interviews, retailer visits, etc.

SAMPLE ACQUISITION

Acquire samples in the field and obtain production details (date, manufacturer, target segment, price, etc.)

Desktop
market
study

Prepare
sampling
plan

Verify plan
with
experts

Field
acquisition

Tile
testing

ZIRCON ANALYSIS

Single laboratory used to avoid any bias

Data
analysis

STATISTICAL ANALYSIS

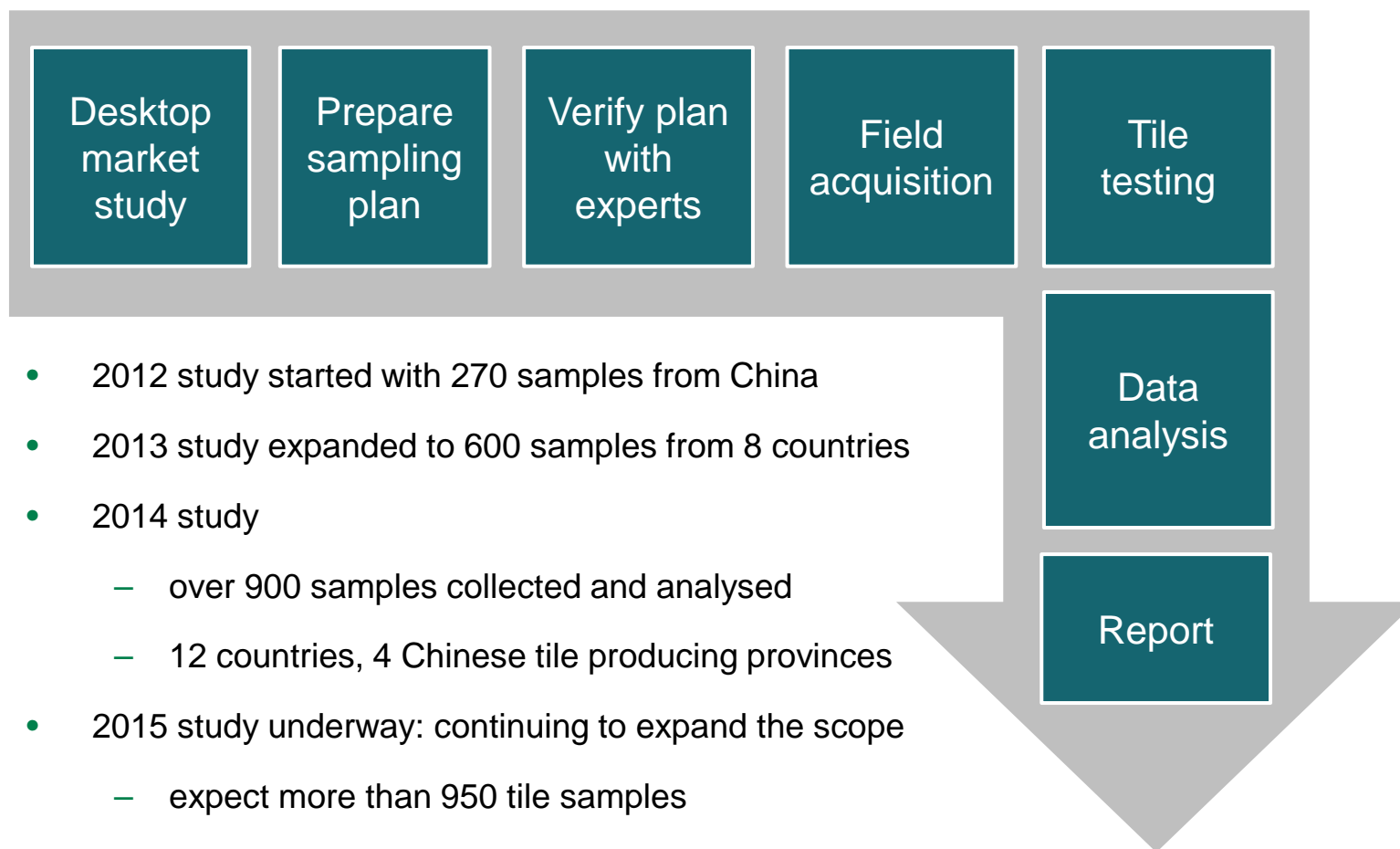
Powerful statistical tool utilised. Also longitudinal analysis over previous years

Report

- Seven step process with much pre-work
- Attempts to cover many industry variables:
 - country and regional-level trends
 - ceramic tile types
 - production methods
 - target markets and price
- Independent verification and sense checks throughout

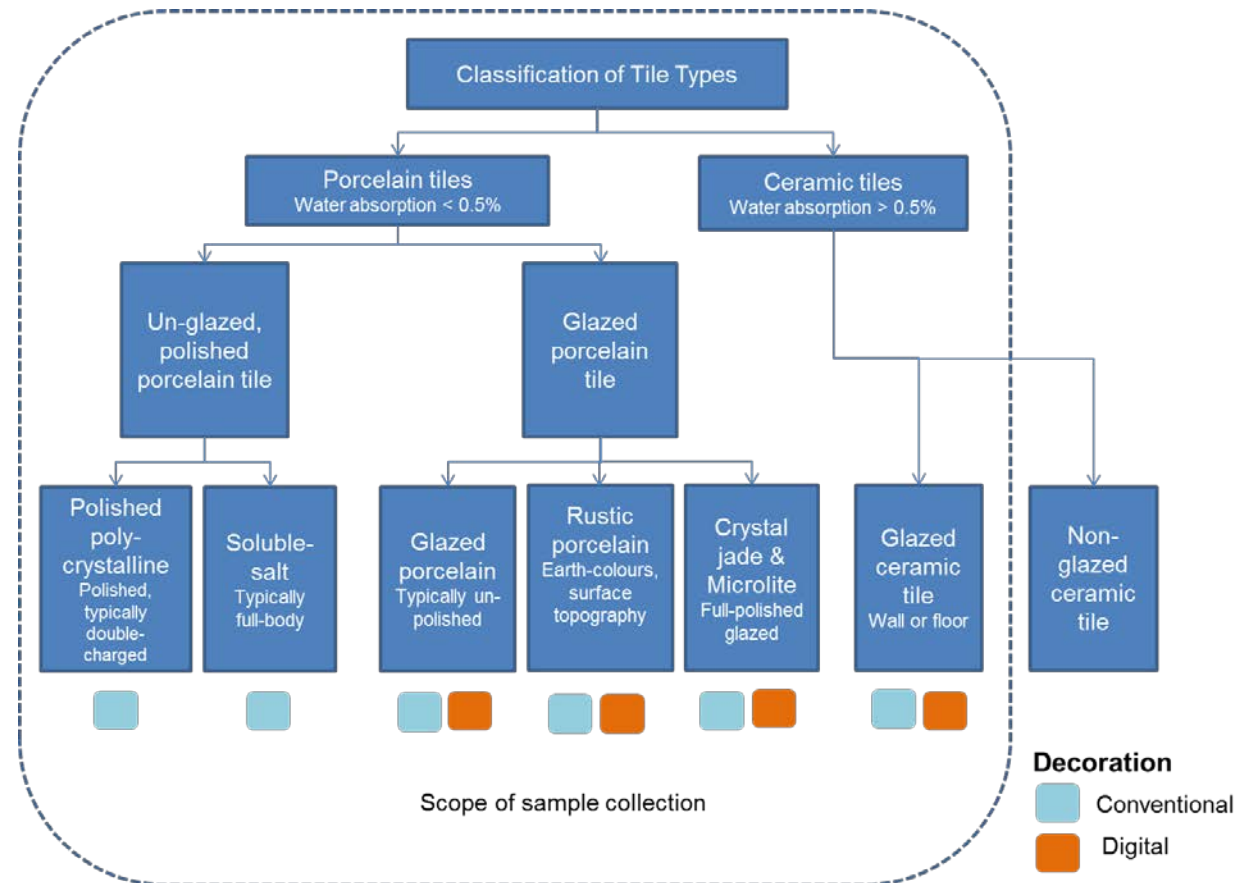
Tile study methodology

Scope continues to broaden



Methodology

Ceramic tile categories



- Manufacturing techniques and zircon usage differ across types
- Detailed categorisation is crucial to form accurate views on trends

2014 Tile Study Results

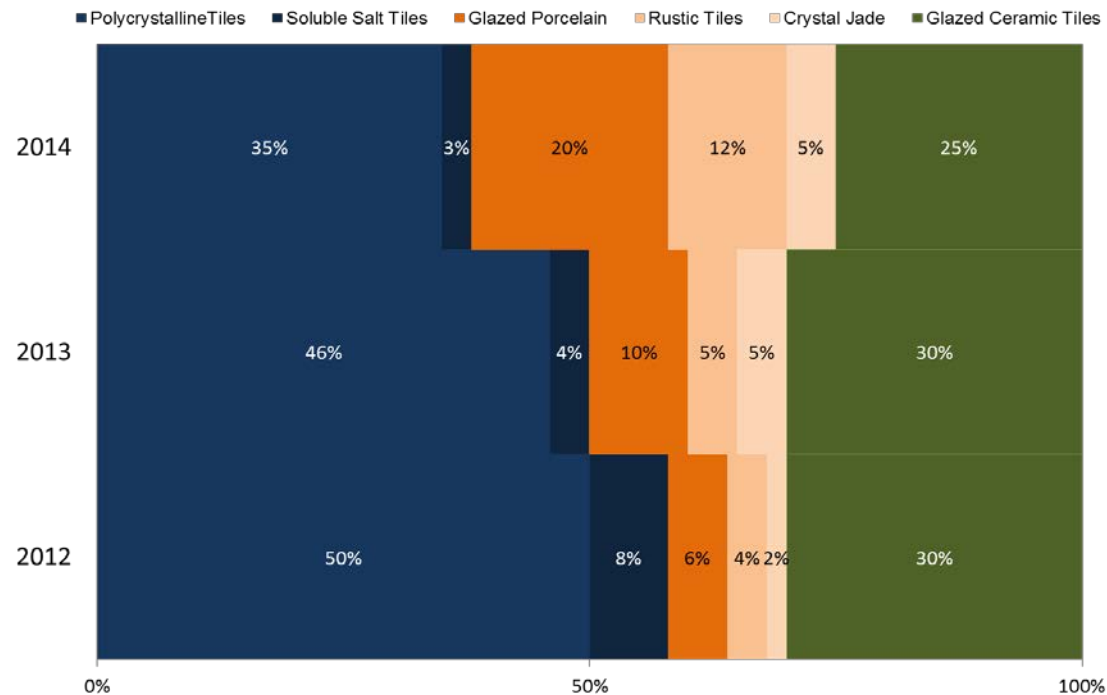
China: tile mix

Key results

- The rise of digital printing is changing the tile product mix
- Significant growth of glazed porcelain and rustic tiles is evident
- Coming at the expense of polished porcelain and soluble salt tiles

Impact on zircon

- Median zircon content of Chinese glazed porcelain is ~ 50% more than polished porcelain
- Increasing demand for opaque frits
- Shifting of zircon opacifier usage from porcelain bodies to engobes & glazes



Source: Ruidow/Iluka China Ceramic Market Study (2014/15)

2014 Tile Study Results

China: zircon intensity of use

Glazed porcelain, rustic and crystal jade tiles

- Show a chair-shaped profile
- A minimum level of zircon
- Below which difficult to substitute out

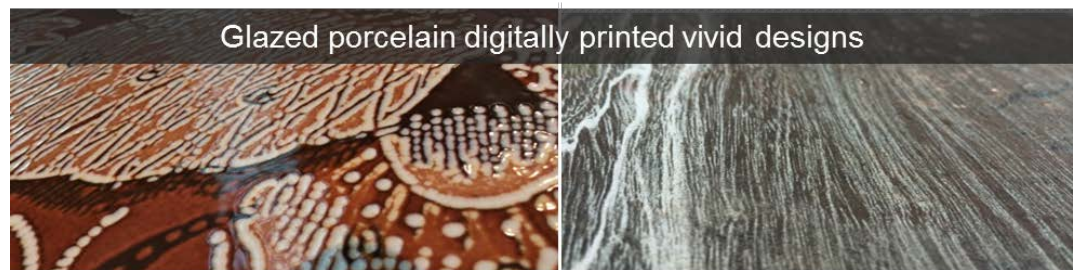
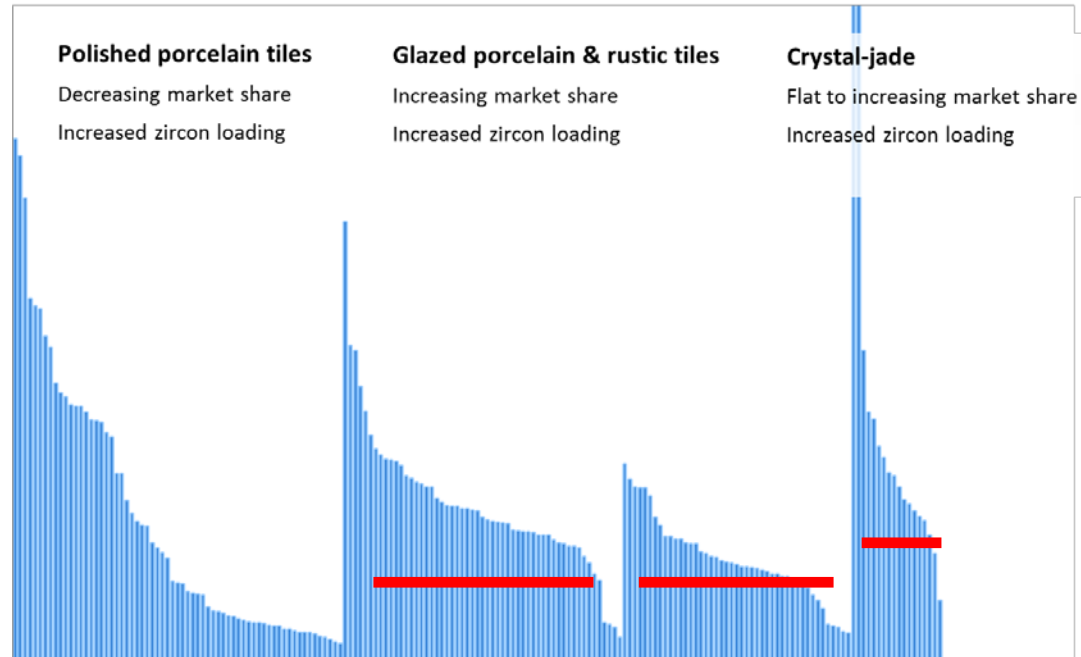
Year on year trends

- Increasing zircon intensity of use for all (ex-glazed ceramic)
- Statistically significant (ex-polished porcelain)

Conclusions

- Digital printing has neutral to positive impact on zircon consumption
- No statistical evidence of reduction in zircon loadings

Zircon content,
grams per sqm



2014 Tile Study Results

China: top tile producers

Key results

- Detailed look into top Chinese ceramic producers (by volume and brand popularity)
- These producers use higher zircon loadings
- Majority of product types showed greater zircon loadings in 2014 vs 2013

Top Chinese Tile Producers	Poly-crystalline	Glazed porcelain	Rustic porcelain	Crystal jade tiles	Glazed ceramic
Producer A	▼	▲	▲		
Producer B	▲	▲		▲	
Producer C	▲	▲		▼	
Producer D	■	▼		▲	
Producer E	▲	▲		▲	▲
Producer F	▼	▲			▲
Producer G	▲	▼	■	▲	

▲ Increased zircon loading by more than 10%

▼ Decreased zircon loading by more than 10%

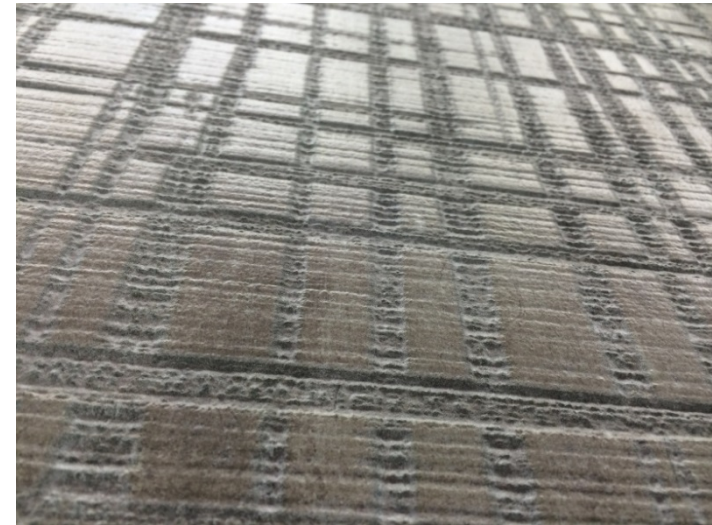
■ Nil change within +/- 10%

Source: Ruidow/Iluka China Ceramic Market Study (2014/15)

2014 Tile Study Results

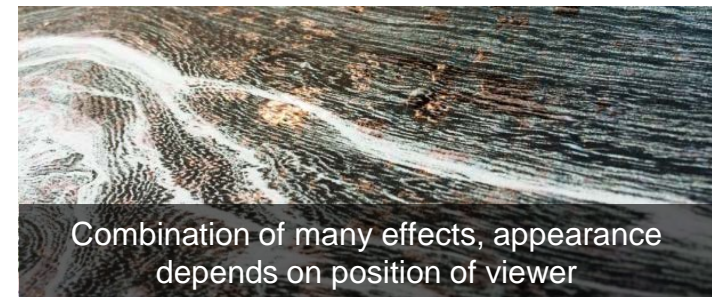
Europe and India

- European loadings stable and higher than Asia
- Continual improvement in product design in Europe
 - finding new ways to differentiate
 - large-nozzle inkjets an enabler
- Indian zircon loadings generally higher than China
 - high adoption rate of digital printing, though early stage
 - increasing focus on design and higher-quality products
 - desire to increase exports



Digital printing and glazing trends

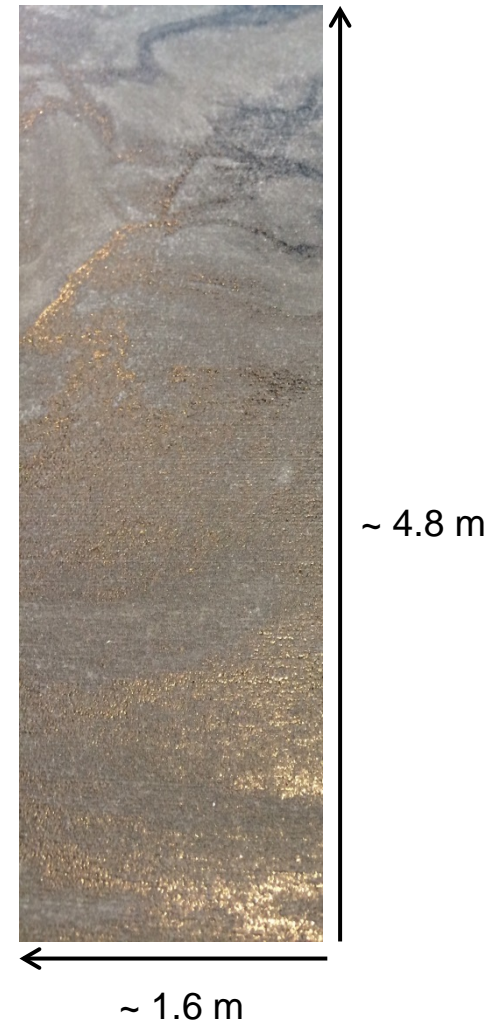
- Digital decoration continues to evolve
- Surface decoration materials
 - increasing quantities applied from 30-40 to 1000+ g/sqm
 - improved colour intensity and aesthetic flexibility
- Larger particle size: from sub-micron to more than 3 microns
 - lower cost of milling; more intense effects possible
- Greater digitalization of tile production lines
 - including glaze and engobe application
 - drivers are increased efficiency and differentiation
 - role of decoration materials more important



Source: Kerajet

Large-format and thin tile trends

- Trend towards larger format tiles
 - dimensions up to 1.6 m x 4.8 m
 - large-format crystal tile products in Europe (similar to crystal jade)
 - high-end products, higher zircon content
- Thin porcelain tiles (3-6 mm)
 - surface decoration previously hampered by production defects
 - solved by improved decorative glazing formulations
 - enables new applications: curved walls, furniture, functional elements
- Valued role for zircon opacifier in these emerging tile types



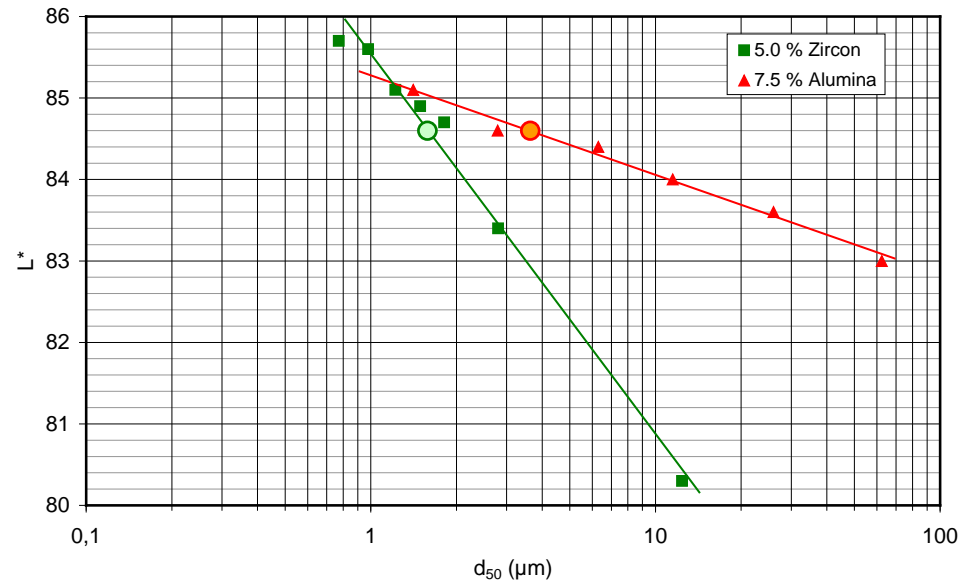
Zircon versus alumina

Value-in-Use Study

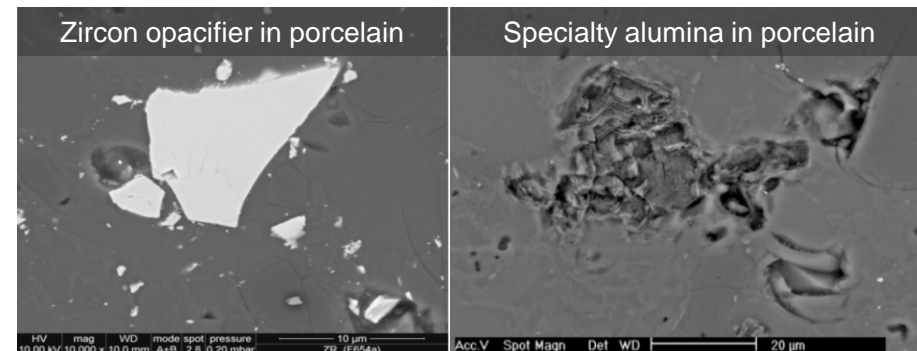
- Comparative technical study completed in 2015
- Confirms the superior performance of zircon
- More alumina needed for the same whiteness
 - approx. 50-70% more
- Alumina has other technical limitations
 - requires higher firing temperature
 - higher pressing pressures required
 - generates greater porosity (micro holes)
 - inferior surface finish for high gloss tiles

Conclusions

- Zircon has superior technical performance
- Relative value-in-use favors zircon



Source: Zircon Industry Association, Iluka Technical Studies



Zircon versus alumina

Practical considerations in China ceramics

- Chinese tile producers generally prefer to use zircon opacifier
- Alumina-based substitutes considered 'inferior' – problems to meet tile product specifications
- Plant practical considerations support continued use of zircon over alumina



- Iluka's Proprietary Ceramic Tile Study now into its fourth edition – robust process
 - Iluka continues to invest in understanding downstream industries / zircon end-uses
 - substantial change in tile product mix driven by digital decoration
 - mostly positive results for zircon consumption
- Emerging trends in ceramics tiles
 - continuing innovation with increasing digitalisation of tile production
 - large and thin-format tiles: significant role for zircon in these new tile types
- Zircon has technical advantages over alumina
 - superior performance on a value-in-use basis
 - still preferred opacifying agent by large parts of the industry



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