

# Nanocomposites and nanomaterials

## Silica-supported titania–zirconia nanocomposites: textural characteristics and particle size distributions

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Silica-supported titania–zirconia nanocomposites (TiO<sub>2</sub>–ZrO<sub>2</sub>/SiO<sub>2</sub>) were prepared using Zr(acac)<sub>4</sub> and C<sub>10</sub>H<sub>11</sub>O<sub>5</sub>Ti solutions in isopropyl alcohol (IPA) added to fumed silica (5 g; previously calcined at 500 °C; S<sub>BET</sub> = 283.4 m<sup>2</sup>/g) at 82.5 °C. The reaction mixture was stirred in a refluxing tube for 1 hour. Then IPA and the acetylaceton reaction product were removed from the mixture by evacuation. The solid product was then dried and calcined at 550 °C for 1 hour. The content of grafted TiO<sub>2</sub> was varied from 3 to 10 wt. % while ZrO<sub>2</sub> content was held constant at 10 wt. % (TiZrSi1 and TiZrSi2, respectively). The specific surface area S<sub>BET</sub> (Table) does not demonstrate significant changes after grafting of titania/zirconia. Particle size distributions (PSD) characteristics for all triple oxides suspensions are bimodal (Fig.).

Table. Textural characteristics of initial silica and triple nanooxides

| Sample           | S <sub>BET</sub> , m <sup>2</sup> /g | S <sub>mic</sub> , m <sup>2</sup> /g | S <sub>meso</sub> , m <sup>2</sup> /g | S <sub>macro</sub> , m <sup>2</sup> /g | V <sub>mic</sub> , cm <sup>3</sup> /g | V <sub>meso</sub> , cm <sup>3</sup> /g | V <sub>macro</sub> , cm <sup>3</sup> /g | V <sub>p</sub> , cm <sup>3</sup> /g | R <sub>p</sub> , nm |
|------------------|--------------------------------------|--------------------------------------|---------------------------------------|--|---------------------------------------|--|---|-------------------------------------|---------------------|
| SiO <sub>2</sub> | 283.4                                | 21.0                                 | 224.9                                 | 37.5                                   | 0.008                                 | 0.348                                  | 0.569                                   | 0.925                               | 29                  |
| TiZrSi1          | 276.4                                | 16.7                                 | 162.6                                 | 97.1                                   | 0.005                                 | 0.083                                  | 1.122                                   | 1.210                               | 39                  |
| TiZrSi2          | 279.7                                | 18.2                                 | 169.2                                 | 92.3                                   | 0.005                                 | 0.066                                  | 1.129                                   | 1.200                               | 45                  |

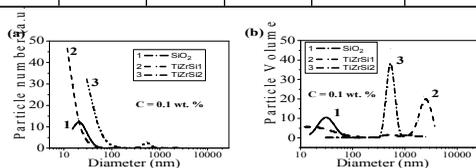


Fig. PSD (a) by particle number and (b) by volume for the initial silica and the triple oxides after ultrasonic treatment (3 min) in aqueous suspensions.

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