

## Vapochromism of 3,3',5,5'-Tetramethylbenzidine-Tetrasilicfluormica Intercalation Compounds with High Selectivity for Water and Acetonitrile

**Authors :** Reira Kinoshita, Shin'ichi Ishimaru

**Abstract :** Vapochromism is a type of chromism in which the color of a substance changes when it is exposed to the vapor of volatile materials, and has been investigated for the application of chemical sensors for volatile organic compounds causing sick building syndrome and health hazards in workspaces. We synthesized intercalation compounds of 3,3',5,5'-tetramethylbenzidine (TMB), and tetrasilicfluormica (TSFM) by the commonly used cation-exchange method with the cation ratio  $TMB^{2+}/CEC$  of TSFM = 1.0, 2.0, 2.7 and 5.4 to investigate the vapochromism of these materials. The obtained samples were characterized by powder XRD, XRF, TG-DTA,  $N_2$  adsorption, and SEM. Vapochromism was measured for each sample under a controlled atmosphere by a handy reflectance spectrometer directly from the outside of the glass sample tubes. The color was yellow for all specimens vacuum-dried at 50 °C, but it turned green under  $H_2O$  vapor exposure for the samples with  $TMB^{2+}/CEC = 2.0, 2.7,$  and 5.4 and blue under acetonitrile vapor for all cation ratios. Especially the sample  $TMB^{2+}/CEC = 2.0$  showed clear chromism both for water and acetonitrile. On the other hand, no clear color change was observed for vapors of alcohols, acetone, and non-polar solvents. From these results, this material can be expected to apply for easy detection of humidity and acetonitrile vapor in the environment.

**Keywords :** chemical sensor, intercalation compound, tetramethylbenzidine, tetrasilicfluormica, vapochromism, volatile organic compounds

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