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## Two-dimensional cardanol-derived zirconium phosphate hybrid as flame retardant and smoke suppressant for epoxy resin

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### Abstract

A new hybrid cardanol-derived zirconium phosphate (CZrP) was successfully synthesized from renewable resource cardanol and its structure was well characterized by nuclear magnetic resonance (NMR), X-ray diffraction (XRD) and scanning electron microscopy (SEM). As a comparison, EP composite containing zirconium phosphate (ZrP) was also prepared using the same procedure. XRD result demonstrated that CZrP displayed more than 5-fold interlayer spacing than pristine ZrP. As a result, the enlarged interlayer spacing of CZrP facilitated the homogeneous dispersion of the nanoadditive in the epoxy matrix. With only 6 wt % CZrP, the peak heat release rate, total heat release, and total smoke production values of the resultant epoxy composite were decreased by 42%, 21%, and 26%, respectively, in contrast to those of virgin EP. The suppressed fire hazards of epoxy composites were attributed to the physical barrier effect induced by the two-dimensional morphology of CZrP. In

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