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Moisture Diffusion Modelling by Using Peridynamics

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The moisture concentration in electronic packages can be determined based on the "wetness" approach. The wetness parameter representing the ratio of the moisture concentration with respect to the saturated concentration value of the material is continuous along dissimilar material interfaces. If the saturated concentration value is not dependent on temperature or time, the wetness equation is analogous to the standard diffusion equation whose solution can be constructed by using any commercial finite element analysis software. However, the time dependency of saturated concentration requires special treatment under temperature dependent environmental conditions such as reflow process. The saturated concentration values of most polymer materials in electronic packages are mostly dependent on temperature. As a result, the wetness equation is not directly analogous to the standard diffusion equation. This study presents peridynamic solution of the wetness equation with time dependent saturated concentration. The approach is computationally efficient as well as easy to implement without any iterations in each time step. The implementation is achieved by using the traditional elements and solvers available in a commercial finite element software.