In order to provide better fuel economy while maintaining the primary safety standards in the reactor, fully ceramic micro-encapsulated (FCM) particles have been modeled in light water reactors. In the last seven months, numerous changes have been made to the design’s geometry, composition and overall layout. Neutronics experts as well as material scientists have collaborated in attempt to construct the most ideal design that will allow higher fuel burnup while diminishing fuel failure concerns. SCALE 6.1 which was developed at ORNL for reactor simulation has been the primary program used to model the design. Because SCALE has restrictions modeling double heterogenous designs such as FCM fuel, the Reactivity-Equivalent Physical Transformation (RPT) method was used. Once this was done, individual pin powers as well as assembly power sharing were analyzed by constructing a fresh feed - once burned assembly colorset. By varying the particle and rod geometry and implementing different uranium-based fuels, it has been concluded that the FCM particle fuel design will need 112% fissile material to that of a standard UO$_2$ rod in order to match lifetime of an 18-month PWR cycle. Once this is established, full core analysis of the design can be done using NESTLE.