How to improve the interfacial performance and obtain high bond strength is a common problem in plasma-sprayed W coatings onto Cu substrates as plasma-facing components (PFC). This phenomenon results from the high interfacial residual stress state created by different thermal expansion coefficients, melting points and elastic modulus between W and Cu during the spraying processes. In this paper, tungsten coatings were deposited onto the oxygen free copper by plasma spraying. Various interlayers were designed to relieve the residual stress between W coatings and Cu substrates. These interlayers included NiCrAl, NiAl, NiCrAlY, W(50 %) Cu (50%) and functionally graded bonding coatings NiCrAl/Cu, W/Cu and so on. SEM, EDS and XRD were employed to investigate the microstructure, photographs and compositions of the interfacial layers. Finite element coupled heat transfer and elastic-plastic thermal stress analysis using finite element analysis (FEA) were utilized to simulate the residual stress generation during the depositing process. The residual stresses were also calculated using this method to explain the variations of the interfacial characteristics with the various interlayers. In addition, tensile tests in conjunction with finite element analysis (FEA) were also performed to better understand the influence of both material selection and component distribution on bonding strength between the coatings and the substrates. As a result, a predicted coating system with the possibility of reducing the residual stress level was also proposed.