Carbon chemical erosion mitigation in the presence of radiating plasma species

The chemical erosion of carbon surfaces is expected to be the dominant mechanism responsible for tritium accumulation in ITER if CFC divertor plates are used during D/T plasma operation. Fortunately, previous experiments performed in the PISCES-B linear plasma device at the University of California at San Diego have revealed the mitigation of carbon chemical erosion by the presence of beryllium impurities contained within a plasma. The beneficial mitigation effect is expected to occur naturally in the ITER device due the transport of material eroded from the first wall into the divertor. Unfortunately, ITER divertor operation requires the presence of carbon radiation in the divertor to achieve the detached plasma solution. Without carbon radiation, an additional radiating species, such as argon, must be intentionally added to the divertor plasma to obtain a detached plasma. It was feared that the addition of argon to the plasma might cause increased erosion and remove the protective beryllium carbide surface layer that is responsible for the mitigation. Fortunately, it has recently been experimentally verified in PISCES-B that the beneficial mitigation effect survives the additional sputtering due to added argon impurities.