The tearing of black-filled natural rubber vulcanizates and the relevance to tire safety

The compounds at the belt-edge (high stress region) of all tires from all manufactures are composed of natural rubber (NR)/carbon black (CB) vulcanizates. This is primarily due to their outstanding resistance to catastrophic tearing. In service, many tires will be underinflated, overloaded, subject to excessive speed and to road hazards (e.g., chuckholes). Tires must not fail catastrophically, even when severe abuse has caused cracks to form in them. Instead, tires must be able to tolerate cracks (damage tolerance) of sufficient size to make it apparent (wobble, thump) to a driver that a tire needs to be replaced. Thus, a driver knows to pull off of the road. Without damage tolerance, the first “warning” that a driver receives may be catastrophic tire blow-out at high speed. This is likely to result in collision and injury. Damage tolerance depends on both tire and compound design. This presentation explains why NR/CB compounds are universally used in the high stress, belt edge region of all tires.