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The Interplay Between Radiation-induced Attenuation, Photodarkening and Photobleaching at Pump Wavelength in Er- and Yb-doped Silica Optical Fibers

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Radiation-induced attenuation (RIA) is the most detrimental effect in erbium- and ytterbium-doped silica fibers (EDF and YDF) operated in radiative environments. In amplifying conditions, RIA develops together with the pump-induced photobleaching (PB) and photodarkening (PD, YDF only) processes. The *measured RIA* then reflects a complex interplay between RIA, PD and PB. To allow a reliable treatment of RIA issues in fiber amplifier models, this interplay has still to be properly understood and modelled. This is the aim of this work. The RIA was measured at 980 nm in 1-2 cm-long fibers. Such short samples are free from amplification and ASE. They allow achieving well controlled and uniform pump power levels, thus releasing measurements from unwanted dependencies on length or pumping scheme. New remarkable properties are hence revealed, as the existence of local reversible RIA equilibrium levels, only determined by the couple dose rate-pump power. The interplay between RIA, PD and PB is also explicated. Local models are introduced for EDF and YDF that apparently include sufficient physics to reproduce all experimental features, qualitatively and quantitatively. The way these models complement and modify the set of equations used in standard amplifier simulations is presented.