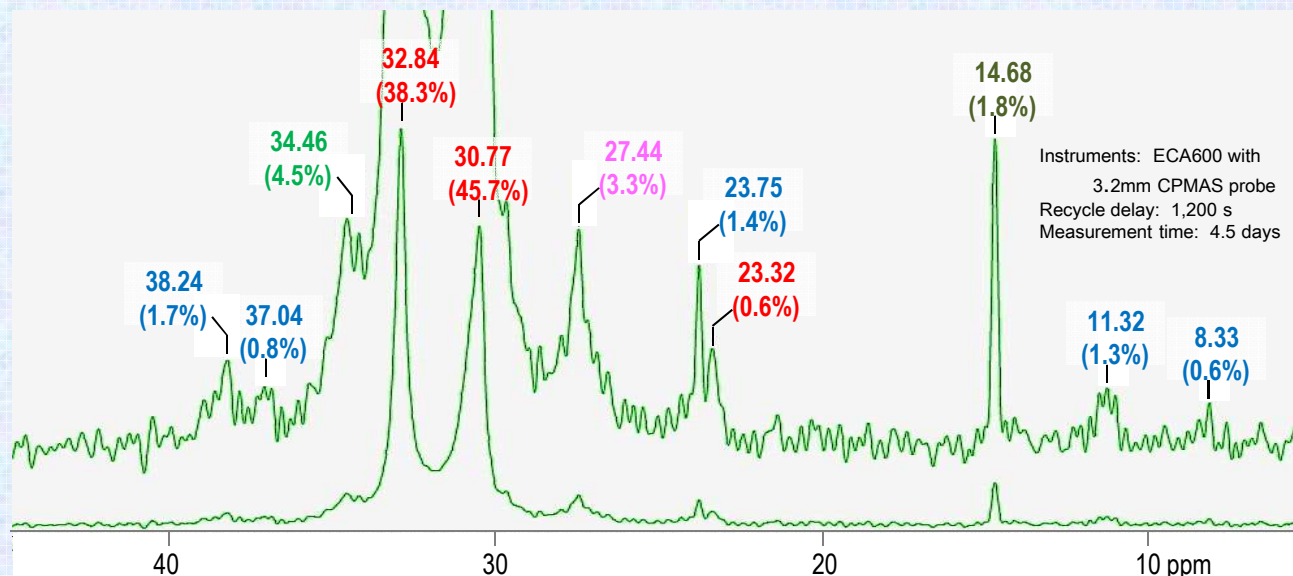


Quantitative NMR for Solid Polymer Materials: Characterization of Low-density Polyethylene

In solid-state NMR, DDMAS spectra (single-pulse decoupling MAS spectra) measured with a sufficiently long recycle delay may provide quantitative information. The signal intensities of the ^{13}C DDMAS spectrum for low-density polyethylene (LDPE; density 0.915) shown below can draw some quantitative conclusions on its microstructures.



■ Crystallinity

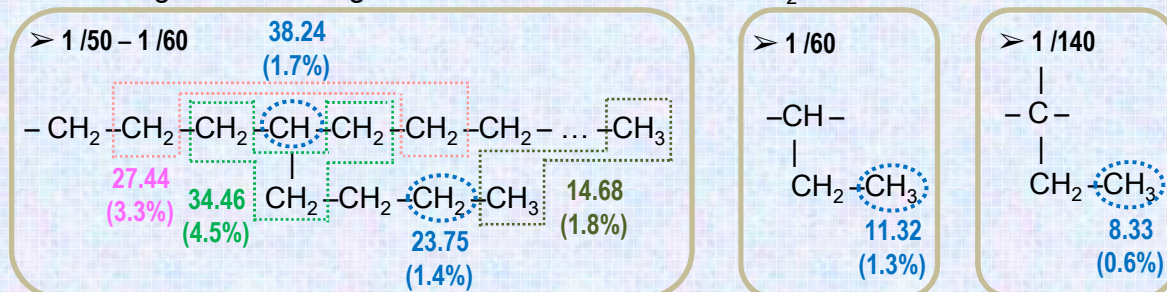
The crystallinity of the sample is evaluated to be approximately 46% from the main CH_2 peak intensity for crystalline phase (32.84 ppm) and that for amorphous phase (30.77 ppm).

■ Molecular weight

The intensity ratio of the peak at 23.32 ppm, assigned to the $\alpha\text{-CH}_2$ in the main chain, and the main peaks at 32.84 and 30.77 ppm proves that the number of CH_2 monomer units is about 300 and the molecular weight M_w is about 4,000.

■ Branching ratio

For example, the intensity ratio of the peaks at 23.75 and 38.24 ppm and the main peaks shows that the following one branching structure exists within 50-60 CH_2 units.



Assignments of the ^{13}C signals follow "Polymer Analysis Handbook" (Asakura Publishing Co. Ltd.) p1102.