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Sequence of mass spectra, obtained using Fourier transform mass spectrometry (FTMS), shows the in situ synthesis of the bare dimer ion CoFe⁺ and its subsequent reactions with 1-pentene in the gas phase. Recent developments in FTMS, involving both software and hardware, now enable selected ions of interest to be stored on the order of seconds during which time they can be mixed with various reagents and their chemistries monitored through a series of more than eight reaction steps (all under computer control). See page 261. [Research by D. B. Jacobson and B. S. Freiser, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907; illustration by J. Christenson and R. Cody, Nicolet Instrument Corp., Madison Wisconsin 53717]