Fischer-Tropsch synthesis is the most important way to synthesize clean, high quality oil fraction without sulphur from coal or natural gas. Today, this process is boomed by energy crisis and environment protection. Fischer-Tropsch synthesis is a process for transforming CO and H\textsubscript{2} into long chain hydrocarbons:

\[
(2n+1) \text{H}_2 + n \text{CO} \rightarrow C_n\text{H}(2n+2) + n \text{H}_2\text{O} 
\]

Supported cobalt catalysts are the system of choice for the Fischer-Tropsch synthesis due to its high activity and high stability. However cobalt-based catalysts are relatively expensive (compared to iron) and need to have a high metal dispersion and long life to offer a good balance between cost and performance. Hence, the development of economically attractive cobalt-based Fischer-Tropsch synthesis catalysts with a high stability requires detailed fundamental understanding of the activation and deactivation mechanisms at play for supported nano-sized cobalt crystallites.

The catalytic performance of cobalt-based systems in Fischer-Tropsch synthesis depends directly on the number and availability of active sites. Active sites for Fischer-Tropsch synthesis over cobalt-based catalysts are reduced cobalt metal surface sites. Before reduction, the cobalt is present as a Co\textsubscript{3}O\textsubscript{4} spinel phase. By comparison with reference spectra, we clearly observed by XANES a two-step reduction of Co\textsubscript{3}O\textsubscript{4} to CoO and then Co\textsuperscript{0}.

![Figure 1: XANES spectra of a Fischer-Tropsch catalyst during reduction treatment under H\textsubscript{2} at 500 °C.](image)

In the same study, we noticed the reduction rate depends on the support. To quantify this reduction rate, we used linear combination of measured and calculated (using the FDMNES code [2]) references XANES spectra. Depending on the composition of the reducing atmosphere and the activation temperature, different cobalt phases (pure cfc, pure hcp or mixture of both) can be obtained what affects directly the material catalytic properties [3].