In keeping up with refiners’ demand for superior technology and premium performance, Advanced Refining Technologies introduced its line of ultra high activity DX series of catalysts. ART’s series of DX™ catalysts has exceeded refinery expectations in their ability to tolerate difficult feed blends in demanding ULSD applications. Key to that effort is maximizing the utilization of the active metals on the catalyst through ART’s chelate chemistry. This impregnation technology offers outstanding potential for significantly improving metals utilization in catalysis due to a superior ability to control metal ions including Co and Ni. It has been shown that when applied correctly, chelates can promote the formation of Type II metal sulfide sites (see Catalagram™ 96, 2004). ART’s premium CDXi has proven its performance advantage with greater stability and exceptional ability to utilize a minimum amount of hydrogen to provide refiners with consistent ULSD production.

In keeping with this tradition, ART is releasing its newest generation of ultra high activity CoMo DX™ catalyst, 420DX™. Figure 39 compares the activity of a variety of CoMo cat-
alysts supplied by ART. Through further optimization of ART’s uniquely engineered pore network, this newest member to the DX™ family is capable of significantly reducing required SOR temperatures for 10 ppm diesel. 420DX™ catalyst offers refiners a significant advantage due to its ability to extract even the most hindered sulfur molecules, yet avoid the unnecessary additional saturation of the monoaromatic compounds which can increase hydrogen consumption.

ART’s dedicated staff of researchers has continued to investigate ways to improve catalytic performance, and surface acidity has been identified as an important property. It is generally accepted that higher surface acidity increases reactions controlled through ring saturation such as nitrogen and hindered sulfur removal. This acidity has also been shown to affect the interaction of active metals with the alumina surface. ART was able to exploit this in the design of ART 420DX™ catalyst. This catalyst utilizes similar impregnation technology as CDXi, but is built on a modified alumina carrier which results in a dramatic increase in activity. The IR chart in Figure 40 shows a double peak at 1624 and 1616 wave numbers as well as one at 1451 which are believed to indicate the presence of Lewis acid sites. This feature was not as prevalent in the spectra of the CDXi support and confirms the incorporation of surface acidity in the new support. While the acid sites give ART 420DX™ catalyst superior performance for both HDS and HDN activity, they are not strong enough to initiate any cracking reactions under typical hydrotreating conditions.

ART has conducted pilot plant testing at various conditions in order to demonstrate the superior performance of how ART 420DX™ catalyst would perform. Figure 41 shows the results of side-by-side testing of CDXi and ART 420DX™ catalyst at 980 psi hydrogen partial pressure and 2500 Scfb H₂/Oil. At these con-
ART 420DX™ catalyst clearly outperforms CDXi by over 20°F at 10 ppm sulfur on a difficult feed containing 30% cracked stocks.

The performance gains seen at high pressures are also available to refiners operating at lower unit pressure and hydrogen circulation. Figure 42 shows the benefits of using ART 420DX™ catalyst at 10 ppm sulfur and lower pressure. A clear 15°F advantage over CDXi is apparent even at only 580 Scfb hydrogen partial pressure and 1500 Scfb H₂/Oil using a feedstock containing cracked material.

The primary benefit of ART 420DX™ catalyst is that the improved HDS and HDN activity does not result in an increase in aromatic saturation and consequently does not increase hydrogen consumption. As can be seen in Figure 43, ART 420DX™ catalyst shows equal aromatic conversion to that of CDXi at lower product sulfur.

This enhanced sulfur removal activity offers refiners greater flexibility in meeting their HDS activity requirements while minimizing hydrogen consumption using ART 420DX™ catalyst as a stand alone catalyst or in combination with ART’s premium NDXi catalyst in a SmART System® for producing ULSD from difficult feeds.