



# KETJENFINE® 907 (KF 907)

## A high-activity Type I catalytic solution for VGO hydrotreating

### Ketjenfine® 907 (KF 907) – A high-activity, high-stability catalyst solution for VGO hydrotreating

KF 907 is a new addition to Albemarle’s Fluid Catalytic Cracking pretreat (FCC-PT) catalyst portfolio. It is applicable as both a standalone catalyst and as a key component in various STAX® configurations, utilizing Albemarle’s proprietary reactor-loading technology.

KF 907 is a Type I NiCoMo catalyst that was specifically designed to achieve high HDS activity with very high stability throughout the entire operating cycle – even in the most demanding conditions.

Higher-activity catalyst solutions help refiners overcome constraints and exploit opportunities. Thus, KF 907 can help refiners meet the challenges imposed by implementation of the new Tier 3 gasoline regulations. It can also help refiners overcome constraints related to unit start-up limitations.

### VGO STAX® FCC-PT Solutions

FCC-PT operations typically only have two reaction zones that vary in length and position during the operating cycle.

Catalyst application strategy must account for reaction Zone 1 growth and Zone 2 shrinkage throughout the cycle, as well as feed properties, operating conditions and objectives, and unit constraints.

NiCoMo catalysts, with their balance of HDS/HDN activities, are well-suited for use in zones 1 and 2 of low- to medium-pressure units and for Zone 1 of high-pressure units that are challenged to achieve Tier 3 gasoline sulfur and cycle length targets. The high activity and stability of KF 907 helps refiners achieve these goals at competitive fill costs.

	Zone 1 (30-60 Vol%)	Zone 2 (40-70 Vol%)
H <sub>2</sub> partial pressure	Higher	Lower
Main HDS reaction Main HDS inhibitor	Direct H <sub>2</sub> S	Direct + hydrogen Organic nitrogen
Main HDN/HDA reaction Main HDN/HDA inhibitor	Hydrogenation Org. nitrogen, aromatics	Hydrogenation Org. nitrogen, aromatics
HDS reaction rate HDN/HDA reaction rate	Fast Very Slow	Slow Slow
Preferred catalyst types (general guidance may vary for specific cases)	CoMo (Low-Med P) (Ni)CoMo (Med P) NiMo (High P)	CoMo (<55 bar ppH <sub>2</sub> ) (Ni)CoMo (Med ppH <sub>2</sub> ) NiMo (>90 bar ppH <sub>2</sub> )

Table 1: VGO STAX® FCC-PT system design for robust operations



“Ketjenfine® 907, Albemarle’s premier, Type I FCC-PT catalyst, is built on our history of innovation and commitment to our customers. Its high HDS activity and superior stability make it ideal for refiners looking to expand their margins while meeting the challenges of Tier 3 gasoline regulations.”

Luca Moraca  
Business Director, VGO FCC-Pretreatment

### Superior Performance, Higher Profitability

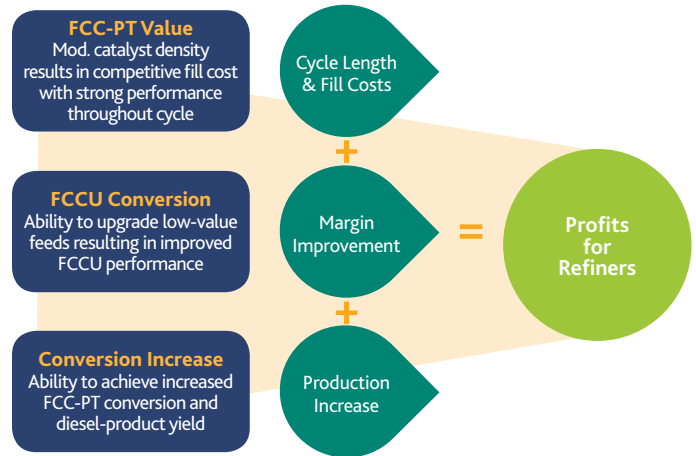


Figure 1: KF 907 gives value to refiners at all ppH<sub>2</sub> levels

### FCC-PT catalysts for any refining objective

Albemarle’s portfolio for FCC pretreatment includes many different catalysts (each available in two different sizes), providing a solution for any refining objective in terms of activity, stability, hydrogen consumption and pressure drop.

These catalysts can be deployed in many different ways according to Albemarle’s proprietary VGO STAX® FCC-PT technology to generate tailored solutions for specific customer requirements.

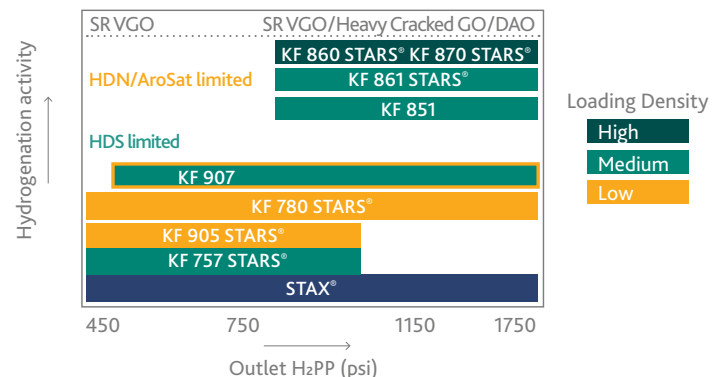


Figure 2: Albemarle’s FCC-PT catalyst portfolio

## Ketjenfine® 907 — A commercially-proven FCC-PT performer

KF 907 is a strong performer in pilot plant tests and commercial unit applications operating across the operations spectrum from low-to-moderate and high-pressure FCC-PT applications. The HDS and HDN RVA benefits of KF 907 are high in reaction Zone 1, and they increase further as HDS and HDN severity increases in Zone 2. Thus, for low and moderate-pressure applications, KF 907 can often be used as a standalone catalyst solution. For high-pressure applications where deep HDS and deep HDN/HDA are the objectives, KF 907 can be applied in Albemarle's proprietary VGO STAX® configurations.

### Ketjenfine® 907 shows up to 20% HDS RVA benefit in low-to-medium-pressure FCC-PT applications

Example shown is a pilot plant test at 870 psi ppH<sub>2</sub>, 680°F and varying LHSV with VGO feed containing 2.0 wt% S, 1600 wppm N and 21.4 API gravity.

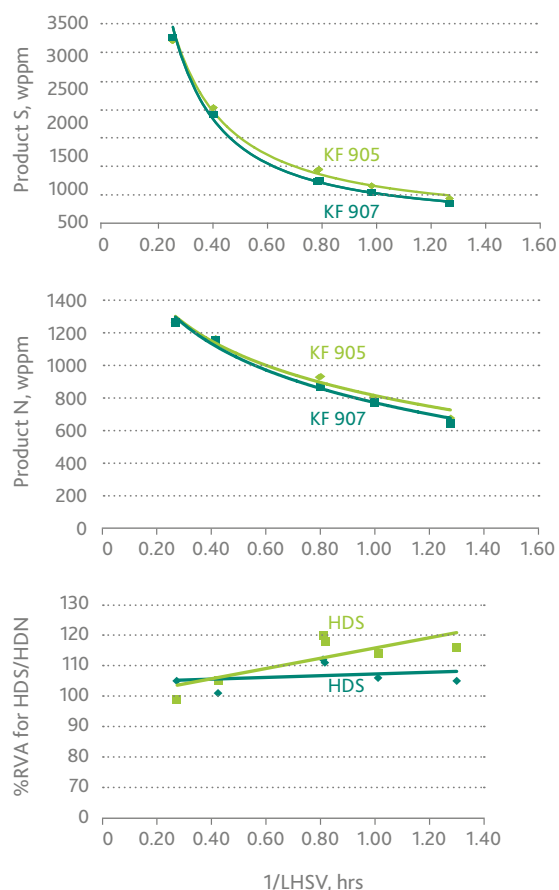


Figure 3: KF 907 FCC-PT performance benefits

## Ketjenfine® 907 Commercial References

Commercial references				
Area	Country	Service	Amount (Mtons)	#Units
AP	Japan	FCC-PT	109	1
AP	Japan	VGO HT	172	1
AP	Japan	FCC-PT	173	1 (2x)
NA	USA	FCC-PT	600	2
NA	USA	FCC-PT	166	1
NA	USA	FCC-PT	180	1
NA	USA	FCC-PT	271	1

Figure 4: KF 907 references

### Commercial performance confirms pilot plant results

KF 907 has been successfully applied in six commercial FCC-PT cycles, including two units operating at >1200 psi ppH<sub>2</sub> in the U.S. The example highlighted below compares KF 907 performance in the current cycle vs. the previous successful cycle with KF 905 STARS® (KF 905).

This unit treats a nominally 50 kBD feed that is a blend of HVGO + HCGO. As shown in the charts, API gravity, Sulfur content and HCGO content are all worse for the current cycle, while product S is lower and density uplift is higher. Deactivation rate for the KF 905 was 1.1 °F/mo, and deactivation rate for the KF 907 is in the range 0.6-1.0 °F/mo.

KF 907 actual WABT (Cycle 2016) versus KF 905 predicted WABT from 2014 cycle

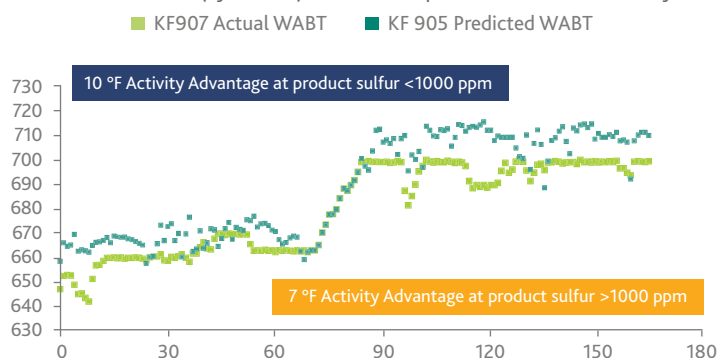


Figure 5: KF 907 commercial unit performance

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