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Alkylated Naphthalene: A booster and a base stock

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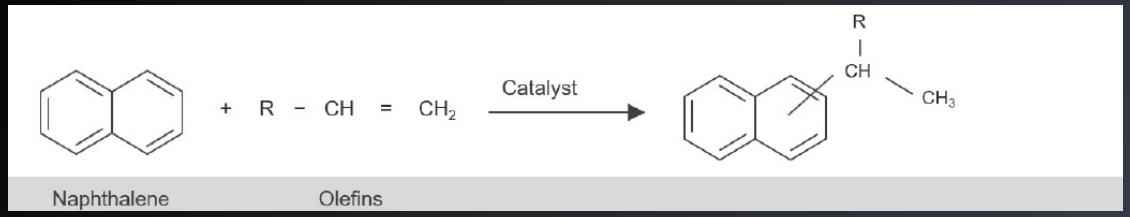
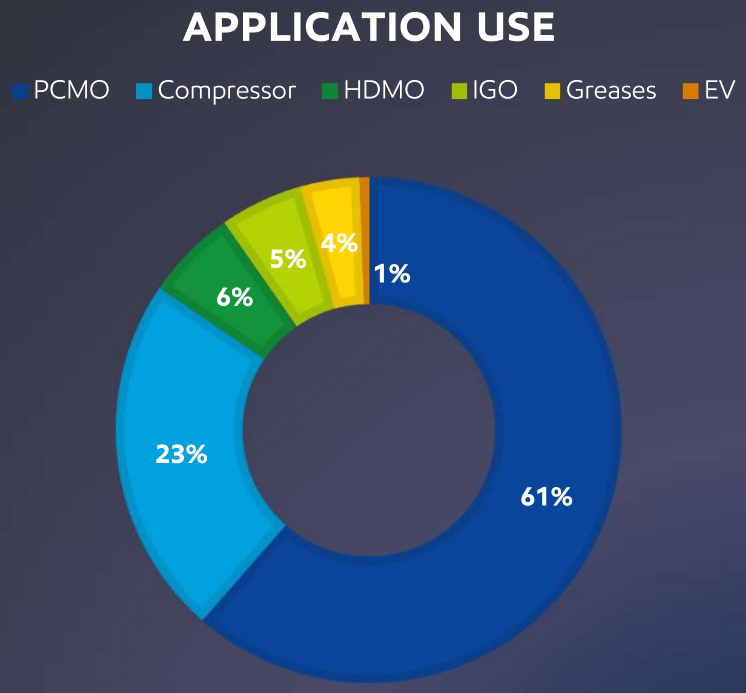
Alkylated Napthalenes | Overview



- API Grp V
- Used in lubricants since the 1940's
- Current uses across the entire lubricant spectrum
- Growing need for high performance properties



Source: ExxonMobil, Kline Grp V study

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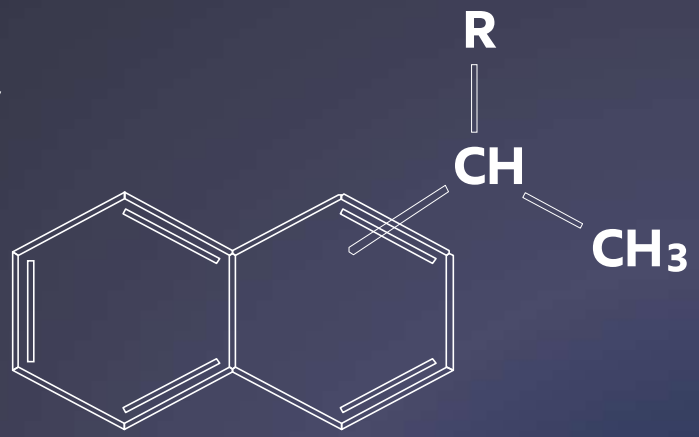
Alkylated Napthalenes | Performance

Alkylated Naphthalene's are engineered high-performance molecules

- Low volatility
- **High thermal & oxidative stability**
- Excellent hydrolytic stability
- Boosts oxidation resistance
- Seal swell capability
- Good solvency
- **Potential to improve additive response**



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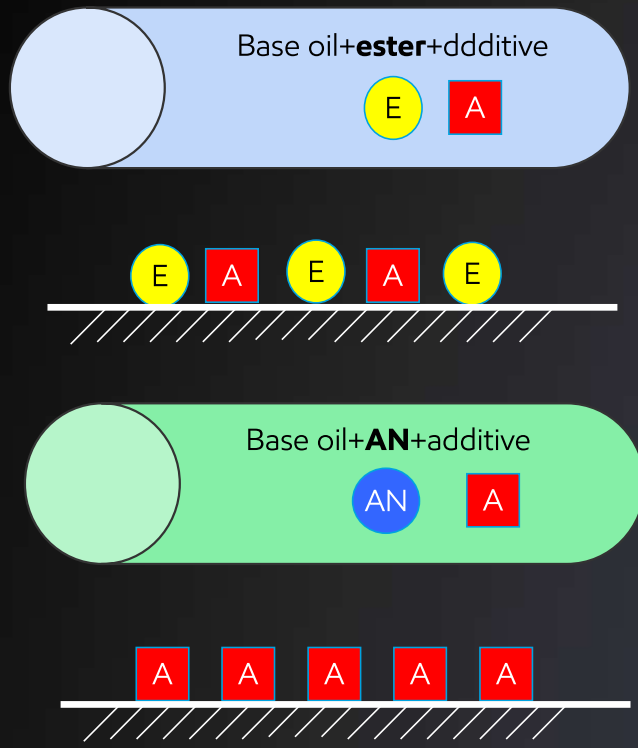
Alkylated Napthalenes | Boosting performance



E = Ester molecule A = Additive molecule AN = AN molecule

4-BALL WEAR TEST[1]

ISO VG 220 Industrial gear oil	**Oil A***	**Oil B***
40 cSt PAO	78%	78%
Adipate ester	20%	----
Synesstic™ 5	----	20%
Additives*	2%	2%

Test conditions	**Wear scar, mm**	
4-Ball wear, 1800 rpm, 93°C,		
60 kg load, 30 min**	0.822	***0.739***
80 kg load, 30 min**	2.094	***0.822***

[1]Source: ExxonMobil internal testing data

* Same additives used in both formulations

* * Spot data measured, results may vary over time

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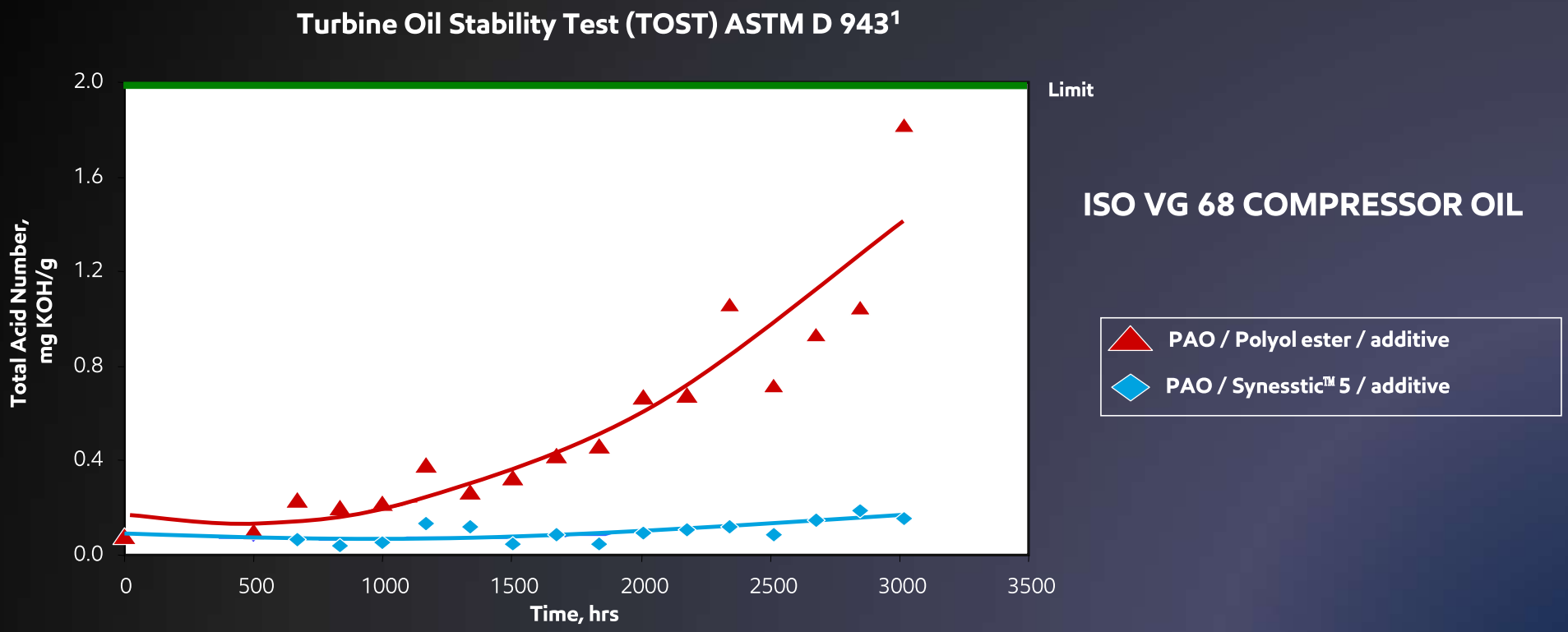
Alkylated Napthalenes | A base stock



[1]Source: ExxonMobil internal testing data

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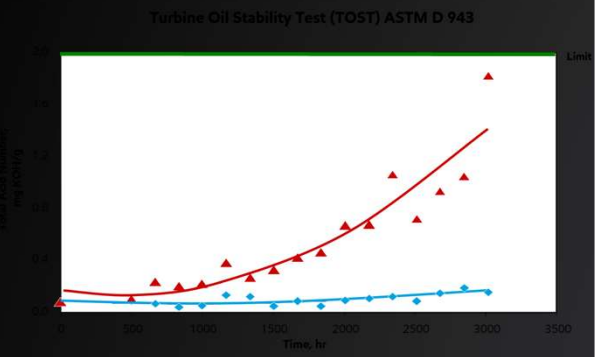
Alkylated Napthalenes | A base stock taken further



Formulation chemistry*	Mineral oil	Gp III, PIB	All ester	PAO/ 20% ester	PAO/ 20% AN	Mostly AN
AN wt%	0	0	0	0	20	86.6
Base oil type	Grp I	Grp III	Ester	PAO/Ester	PAO/AN	AN/PAO
RPVOT, ASTM D2272, mins	415	1940	1130	1240	1365	1848
TOST ASTM D 943, hrs.**	2928.00	10000+	<400	929.00	10000+	10000+
Air release, ASTM D3427, mins to 0.2% air**	8.40	2.20	2.00	2.10	2.50	7.70
ExxonMobil Proprietary Accelerated Test[1]						
Compressor Oil life, hours	654.00	645	1200	1313.00	2148	5000+

Use of concentrated Alkylated Naphthalene may substantially extend compressor oil lifespan

[1]Source: ExxonMobil internal testing data

* Additive chemistry adjusted per formulation

* * Spot data measured, results may vary in time

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Alkylated Napthalenes | Summary

Alkylated Naphthalene's are engineered high-performance molecules	Synessti c™ 5	Synessti c™12	Synesstic™ 8 (Experimental)*
Specific gravity @ 15.6^{0}C, ASTM D4052	0.908	0.887	0.893
Viscosity @ 100^{0}C, cSt, ASTM D445	4.7	12.4	8.2 – 8.6
Viscosity @ 40^{0}C, cSt. ASTM D445	29	109	60 - 64
Brookfield viscosity @ -30^{0}C, cP. ASTM D2983	3,950	22,000	15,580
Color, ASTM 1500	<1.5	<4.00	0.5
Viscosity index, ASTM D2270	74	105	105
Flash point open cup ^{0}C, ASTM D92	222	258	237
Pour point, ^{0}C, ASTM D5950/D97	-39	-36	-33
Noack volatility, wt. % Loss, ASTM D5800	12.7	4.5	5.1
Total Acid number, mgKOH/g, ASTM D974 (mod)	<0.05	<0.05	<0.05

Future industry requirements continuing to drive the need for step out performance characteristics; ExxonMobil to provide an additional AN molecule for formulation selection

* Synesstic 8 to be available for sampling in Q1 2024, with typical data present

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Thank you

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