www.sge.com

PRODUCT DATA

HT5

HIGH TEMPERATURE STATIONARY PHASE FOR CAPILLARY GAS CHROMATOGRAPHY

INTRODUCTION

HT5 is the first carborane modified siloxane phase to be commercially available on fused silica capillary columns. With an equivalent polarity to 5% phenyl, HT5 is a bonded phase capable of operating at temperatures up to 480°C (with exterior coated aluminum columns); a temperature well above the maximum limits of many modern gas chromatographs.

For many classes of high molecular weight materials, gas chromatography using high temperature columns, is a more desirable technique than alternatives such as HPLC and SFC. HT5 equips the analyst with a robust column, providing higher resolution, shorter analysis time and ease of operation.

Clearly, the performance limitations of high temperature gas chromatography will be the thermal stability of the compounds to be analysed, and their possible interaction with the capillary column. Well suited to this technique are many high molecular weight polar and functionalised compounds.

Although HT5 was designed with high temperature analysis in mind, the column is also well suited for operation at more conventional temperatures (280°C/300°C). HT5 effectively exhibits zero bleed at these temperatures which makes it perfectly suited for use with mass spectrometers and other specific detector systems where column bleed is critical. The siloxane-carborane backbone of the HT5 stationary phase, which gives HT5 its outstanding thermal stability, also provides some unusual, and often very useful, selectivity characteristics.

A quick, simple and reliable chromatographic technique is now available for the analysis of high molecular weight waxes and polyethylenes. Due to the excellent resolving power of the HT5 column and a temperature operating range of 10°C to 480°C, the analysis of hydrocarbons from C4 to C100 and above can be achieved in a relatively short analysis time.

Example of High Temperature Application

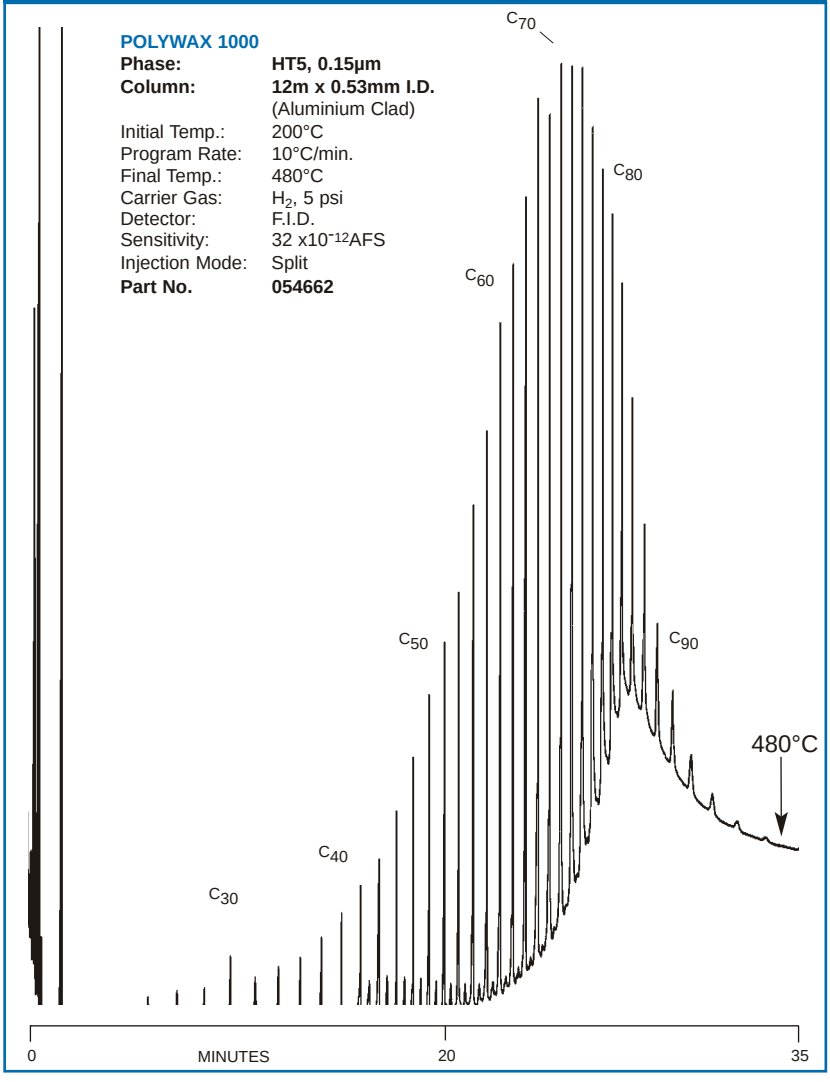


Figure 1 - Polynuclear Aromatic Hydrocarbons

Phase:	**HT5, 0.1µm**
Column:	**25m x 0.22mm I.D.** (Polyimide Clad)
Initial Temp.:	80°C
Program Rate:	5°C/min.
Final Temp.:	290°C, 10 min
Carrier Gas:	H_2, 10 psi
Detector:	F.I.D.
Sensitivity:	16 x10^{-12}AFS
Injection Mode:	Split
Part No.	**054632**

1. Naphthalene
2. Acenapthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Flouranthene
8. Pyrene
9. Benzo (a) anthracene
10. Chrysene
11. Benzo (b) flouranthene & Benzo (k) flouranthene
12. Benzo (a) pyrene
13. Indento (1, 2, 3-cd) pyrene
14. Dibenzo (a, h) anthracene
15. Benzo (g, h, i) perylene

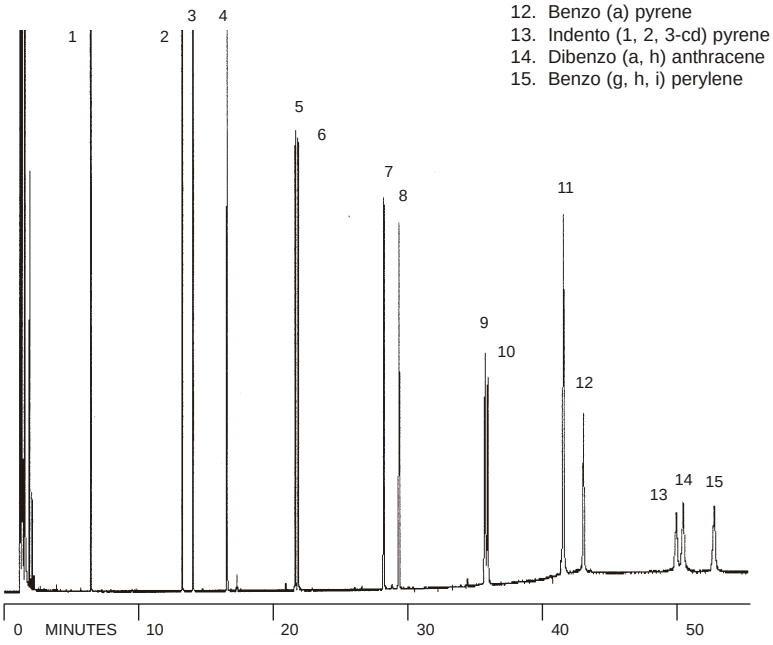
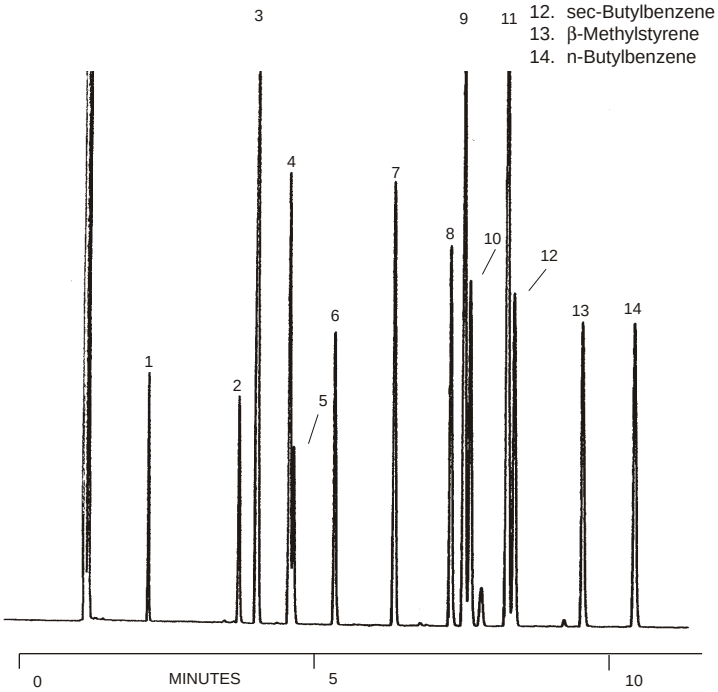


Figure 2 - Substituted Benzenes

Phase:	**HT5, 0.1µm**
Column:	**25m x 0.32mm I.D.** (Polyimide Clad)
Initial Temp.:	40°C, 2 min
Program Rate:	4°C/min.
Final Temp.:	70°C, 4 min
Carrier Gas:	H_2, 6 psi
Detector:	F.I.D.
Sensitivity:	32 x10^{-12}AFS
Injection Mode:	Split
Part No.	**054652**

1. Toulene
2. Ethylbenzene
3. m & p-Xylene
4. Styrene
5. o-Xylene
6. iso-Propylbenzene
7. n-Propylbenzene
8. 1, 3, 5-Trimethylbenzene
9. α-Methylstyrene
10. tert-Butylbenzene
11. 1, 2, 4-trimethylbenzene & iso-butybenzene
12. sec-Butylbenzene
13. β-Methylstyrene
14. n-Butylbenzene

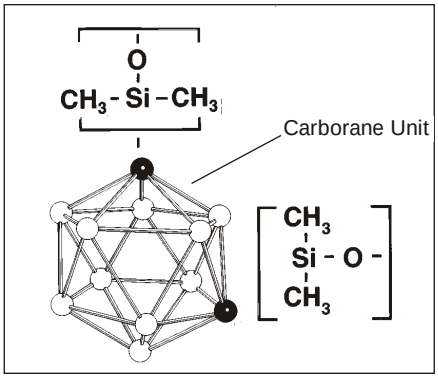


SPECIFICATIONS

HT5 is a carborane modified polysiloxane with an equivalent polarity of 5% phenyl.

Min. Operating Temp.=	10°C
Max. Continuous Temp.=	460°C*
Max. Cycling Temp.=	480°C*

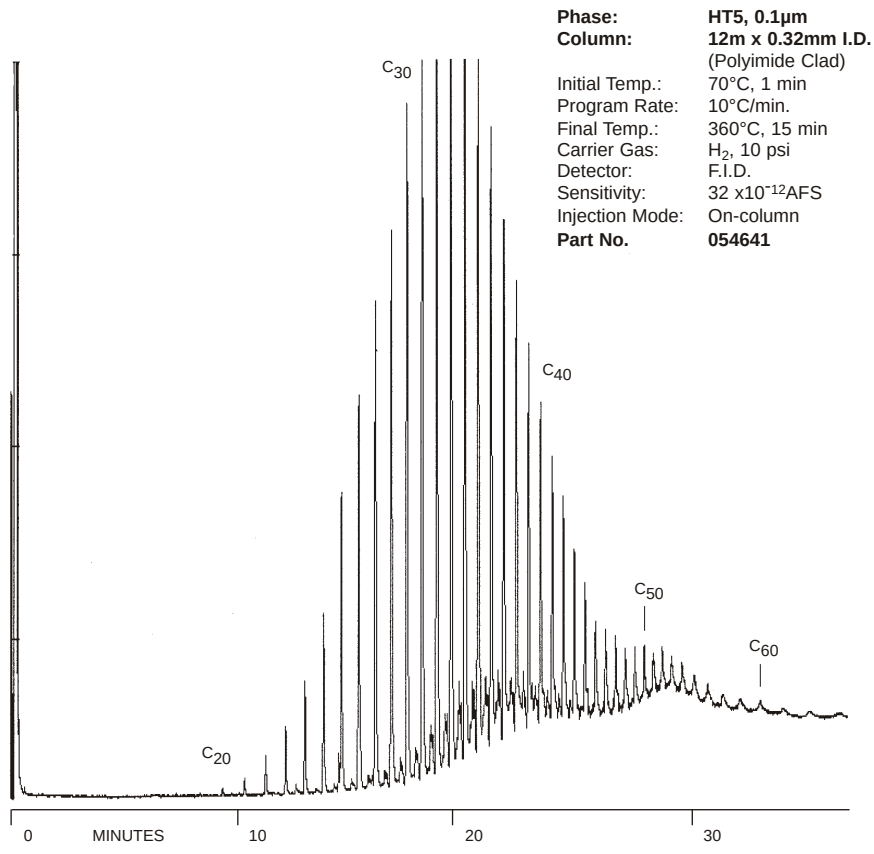
* aluminum clad column



The analysis of 16 PAH (Polynuclear Aromatic Hydrocarbons) illustrates the compatibility of the HT5 column for this application (figure 1). Excellent separation of the isomer pairs phenanthrene/anthracene and benzo(a)anthracene/chrysene is achieved while maintaining a constant stable baseline.

HT5 can also be used to separate complex mixtures of volatile alkyl substituted aromatics (figure 2).

Figure 3 - Wax Sample



These two chromatograms illustrate the range of high and low molecular weight waxes that can be analysed on polyimide (figure 3) and aluminium coated (figure 4) HT5 columns.

Though restricted to a maximum temperature of 360°C-370°C, the polyimide coated capillaries still allow a considerable range of hydrocarbons to be analysed. In the above example straight chain hydrocarbons up to C60 are analysed without difficulty.

Figure 4 - Crude Oil and Wax Mixture

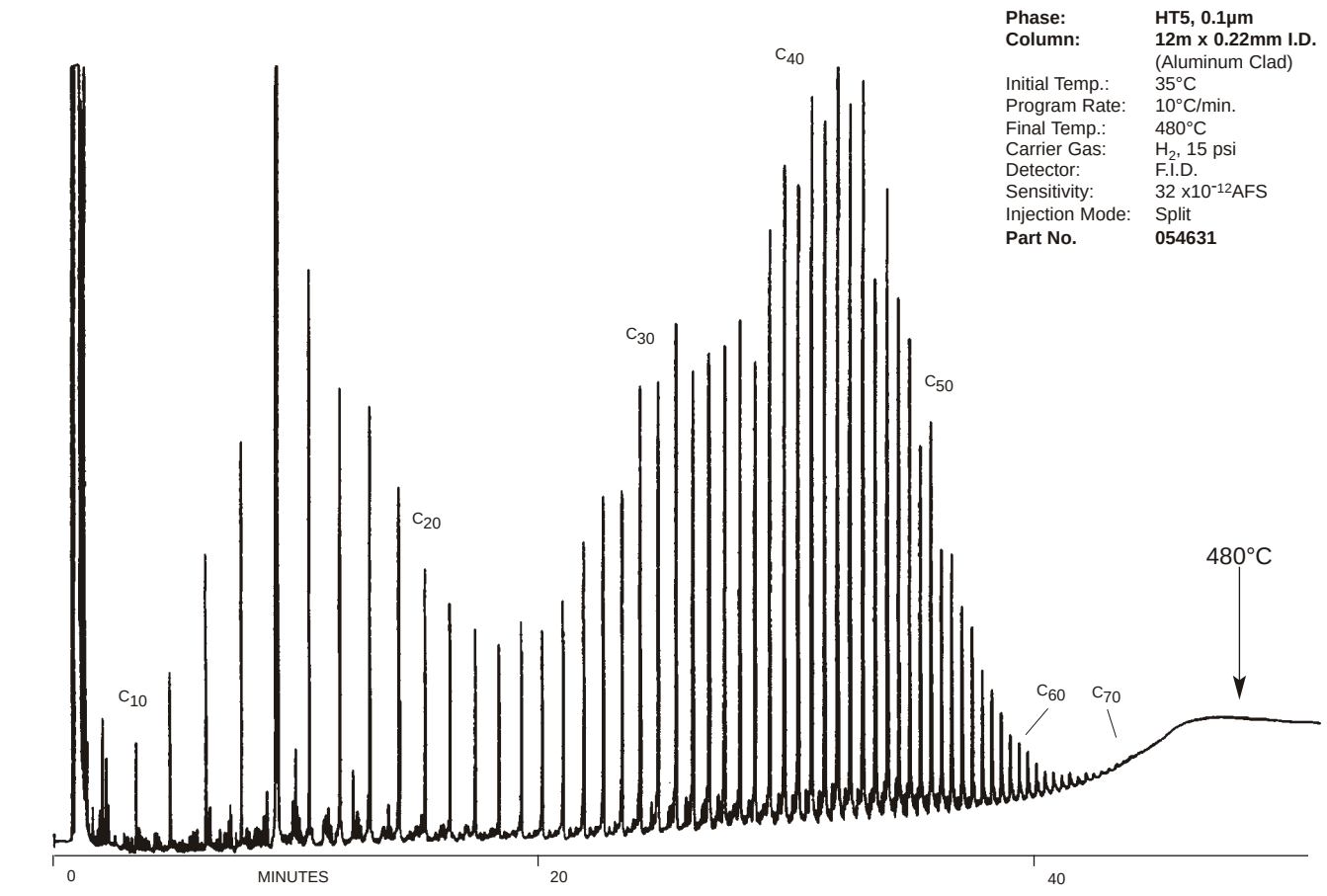


Figure 5 - Porphyrins

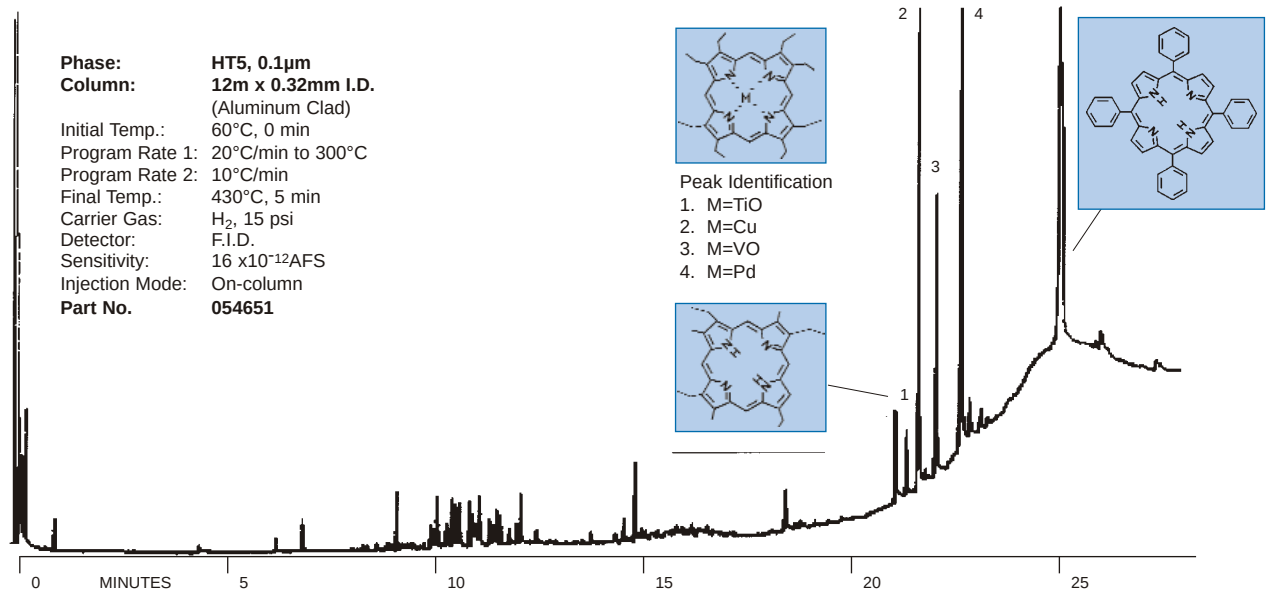


Figure 6 - Triglycerides Standard

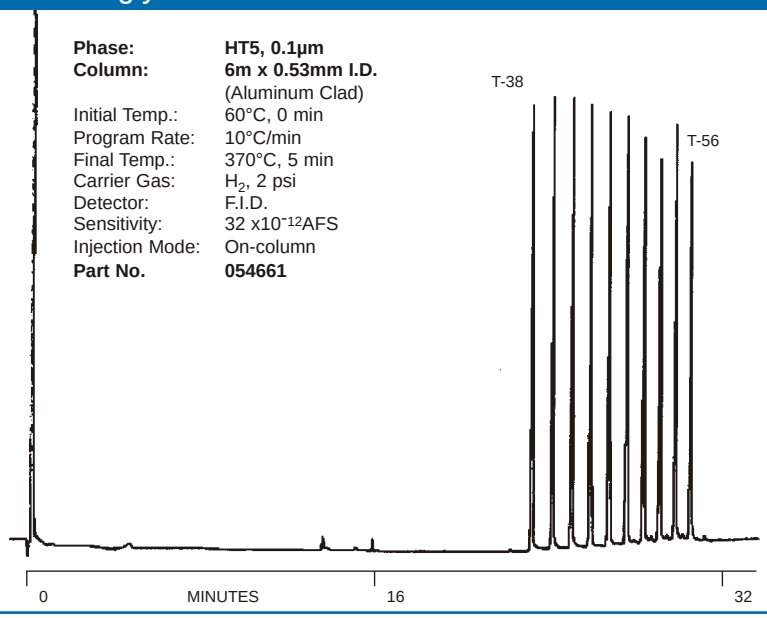
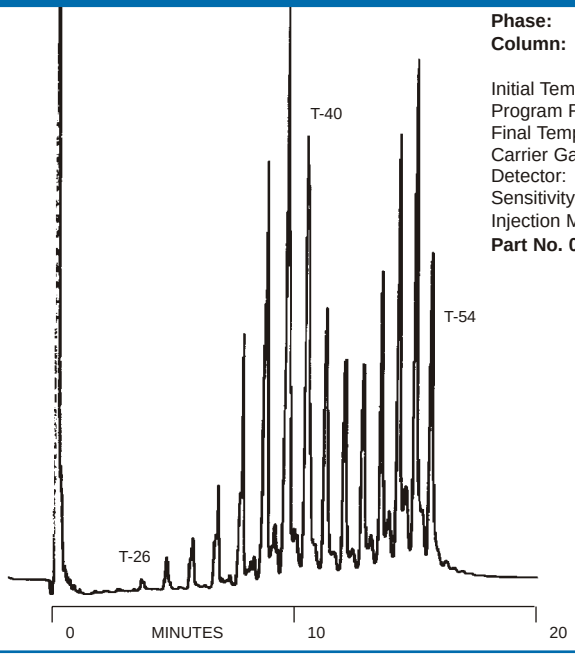


Figure 7 - Butter Milk Fat



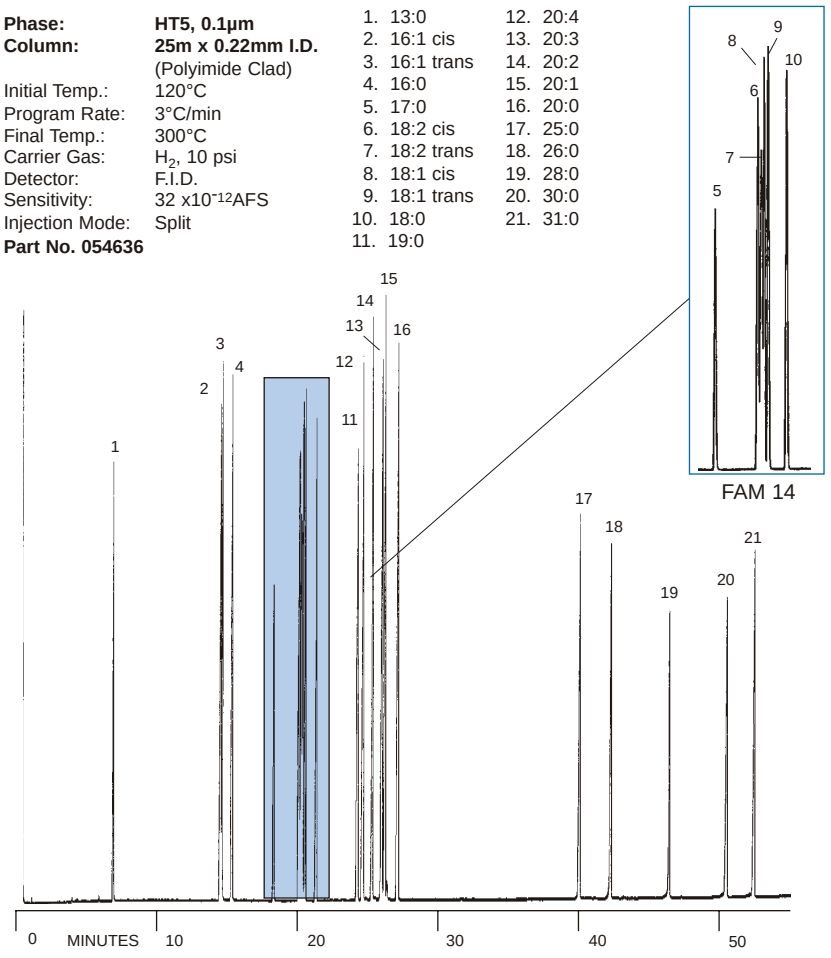
Another example of the unique quality of HT5 capillary columns is in the analysis of metal complexed and free based alkylporphyrins (figure 5). Traditionally their analysis has required the preparation of low boiling point derivatives as no stationary phase could operate at temperatures higher than 400°C. Because alkylporphyrins are very thermally stable, their analysis, either as metal complexes or free bases, becomes extremely easy. The ease in which this analysis can be performed is well illustrated, where baseline resolution is obtained for a mixture of metal complexed and based alkylporphyrins.

HT5 allows the routine analysis of triglycerides by capillary gas chromatography to be performed without difficulty. The separation of triglycerides by their respective carbon number is of considerable importance particularly in the various food, cosmetic and confectionery industries. A range of triglyceride standards analysed (figure 6) using a relatively short column illustrates the high level of performance the HT5 column can provide. Butter milk fat was also analysed using a HT5 column of only 6 meters in length and 0.53 mm I.D (figure 7). Excellent resolution between each respective carbon number group was achieved with an analysis time of only 17 minutes.

Figure 8 - Fame Mixture

Phase: **HT5, 0.1µm**
Column: **25m x 0.22mm I.D.**
(Polyimide Clad)
Initial Temp.: 120°C
Program Rate: 3°C/min
Final Temp.: 300°C
Carrier Gas: H_2, 10 psi
Detector: F.I.D.
Sensitivity: 32 x10^{-12}AFS
Injection Mode: Split
Part No. 054636

1. 13:0
2. 16:1 cis
3. 16:1 trans
4. 16:0
5. 17:0
6. 18:2 cis
7. 18:2 trans
8. 18:1 cis
9. 18:1 trans
10. 18:0
11. 19:0
12. 20:4
13. 20:3
14. 20:2
15. 20:1
16. 20:0
17. 25:0
18. 26:0
19. 28:0
20. 30:0
21. 31:0



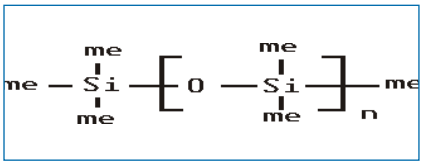
The HT5 stationary phase has unique selectivity because of its siloxane backbone. An example of this unique characteristic is the analysis of fatty acid methyl esters where excellent resolution of the C18:1 and C18:2 cis/trans isomers is achieved (figure 8).

With a maximum operating temperature some 150°C higher than conventional siloxane phases, the analysis of much higher molecular weight methyl esters or other derivatised compounds would become routine.

An indication of the superior stability of HT5 as a stationary phase for capillary gas chromatography is its ability to actually chromatograph many materials that themselves have been used as stationary phases. The analysis of DC200 (500cs) containing long chain siloxanes is easily performed with a HT5 column (figure 9).

Figure 9 - DC200 Silicon Oil

Phase: **HT5, 0.1µm**
Column: **12m x 0.32mm I.D.**
(Aluminum Clad)
Initial Temp.: 100°C
Program Rate: 10°C/min, 10 min hold
Final Temp.: 360°C
Carrier Gas: H_2, 10 psi
Detector: F.I.D.
Sensitivity: 32 x10^{-12}AFS
Injection Mode: On-column
Part No. 054651



HT5

HIGH TEMPERATURE STATIONARY PHASE FOR CAPILLARY GAS CHROMATOGRAPHY

WHICH COLUMN SHOULD I SELECT ?

Though originally developed for high temperature applications, HT5 has also found a unique place in the analysis of complex mixtures analysed at more conventional temperatures
(280°C-300°C). To accommodate these different areas of application, HT5 is available with two protective fused silica outer coatings, aluminum (AQ) and polyimide .

APPLICATIONS BELOW 360°C-370°C

For analyses performed at temperatures below 370°C SGE recommends the use of the conventional polyimide outer coated fused silica (QC).
The polyimide used is a high temperature material, and can withstand continuous operation at these elevated temperatures for prolonged periods of time.

ORDERNG INFORMATION - Phase Type HT5

Polyimide Clad Columns

ID mm	Film µm	10m	15m	30m	
0.25	0.1	–	054633	054634	
0.32	0.5	–	054667	054668	
0.53	0.5	054670*	054671*	054672	

ID mm	Film µm	6m	12m	25m	
0.22	0.1	–	054631	054632	
0.32	0.1	–	054641	054642	
0.53	0.1	054655	–	–	
0.53	0.15	054656	054657	054658	

Aluminum Clad Columns

ID mm	Film µm	6m	12m	25m	50m
0.22	0.1	–	054635	054636	–
0.32	0.1	–	054651	054652	054653
0.53	0.075	054673**	–	–	–
0.53	0.1	054661*	–	–	–
0.53	0.15	–	054662*	054665	–

**Simulated Distillation **5 meter column for Simulated Distillation*

www.sge.com

Publication No. PD-0003-C Rev:02 03/03

SGE International Pty. Ltd.
Toll Free:1800 800 167
Tel: +61 (0) 3 9837 4200
Fax: +61 (0) 3 9874 5672
email: support@sge.com

SGE Incorporated (USA)
Toll Free: 800 945 6154
Fax: +1 512 836 9159
email: usa@sge.com

SGE Europe Ltd. (UK)
Tel: +44 (0) 1908 568 844
Fax: +44 (0) 1908 566 790
email: uk@sge.com

SGE (France) Sarl
Tel: +33 (0) 1 6929 8090
Fax: +33 (0) 1 6929 0925
email: france@sge.com

SGE (Italia) Srl.
Tel: +39 06 4429 0206
Fax: +39 06 4429 0724
email: sge.italia@tin.it

SGE Deutschland GmbH
Tel: +49 (0) 6151 860486
Fax: +49 (0) 6151 860489
email: germany@sge.com

SGE China Service Centre
Tel: +86 (10) 6588 8666
Fax: +86 (10) 6588 6577

SGE Japan Inc.
Tel: +81 (45) 222 2885
Fax: +81 (45) 222 2887
email: japan@sge.com

SGE India
Tel: +91 (022) 471 5896
Fax: +91 (022) 471 6592
email: sgeindia@vsnl.com