

# New Uses for the Rtx-200 Trifluoropropyl Phase

- . 360°C thermal stability
- . low bleed with FIDs, ECDs, MSDs
- . selective for lone pair electron functionalities
- . ideal confirmation column for many EPA analyses

Trifluoropropyl polysiloxane stationary phases have unique selectivity due to the electrophilic nature of the fluorine atom pendant on the polymer backbone. This selectivity intensifies interactions with compounds that contain groups displaying lone pair electrons such as alcohols, ketones, nitro-containing compounds and electron rich molecules such as Freons. This selectivity switches elution orders and resolves compounds that methyl, phenyl, cyano, and Carbowax% containing phases cannot.

While trifluoropropyl stationary phases have been recognized for their unique selectivity, they have also suffered from low thermal stability, high bleed, poor inertness, and incomplete cross-linking or surface bonding. Restek's new trifluoropropyl polymer, Rtx-200, eliminates the standard problems associated with typical trifluoropropyl phases. Because of the complete surface deactivation and high phase purity, inertness is exceptional allowing highly active compounds to elute without tailing or adsorbing onto the column surface. Since the polymer is bonded to the surface and completely cross-linked, it can be solvent rinsed to clean the sample residue from the polymer.

## ECD Bleed

The Rtx-200 is synthesized with advanced polymer technology and is coated on a carefully matched surface deactivation, increasing thermal stability to over 360°C. Background is minimal even on halogen specific detectors such as ECD's. Figure 1 shows an ECD bleed profile of

Figure 1 - The high degree of immobilization allows the Rtx-200 to be used with ECD despite the presence of fluorine in the polymer.

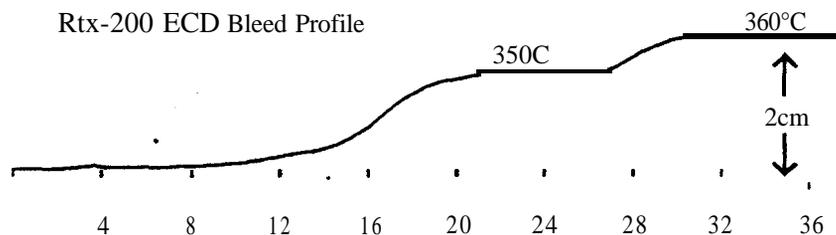
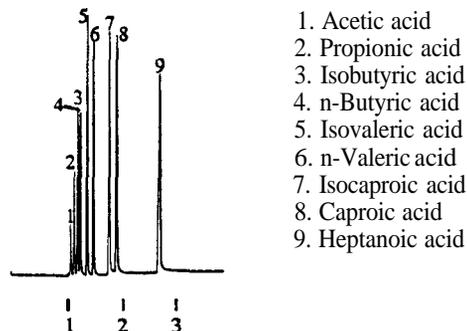


Figure 2 - Excellent peak symmetry of volatile free fatty acids is exhibited on an Rtx-200 capillary column.



1. Acetic acid
2. Propionic acid
3. Isobutyric acid
4. n-Butyric acid
5. Isovaleric acid
6. n-Valeric acid
7. Isocaproic acid
8. Caproic acid
9. Heptanoic acid

30m, 0.25mm ID, 0.25um Rtx-200 (cat.# 15023)  
0.8ul split injection of a free fatty acid standard.  
Concentration approximately 10 to 20ng/pl.  
Oven temp.: 90°C isothermal  
Inj. & det. temp.: 250°C  
Carrier gas: Hydrogen  
Linear velocity: 40cm/sec. (flow rate: 1.1cc/min.)  
FID sensitivity: 4x10<sup>-11</sup>AFS  
Split vent: 40cc/min.

an Rtx-200 column that was temperature programmed to 350°C and 360°C. Even at the column's maximum operating temperature, the ECD bleed is minimal.

## Applications

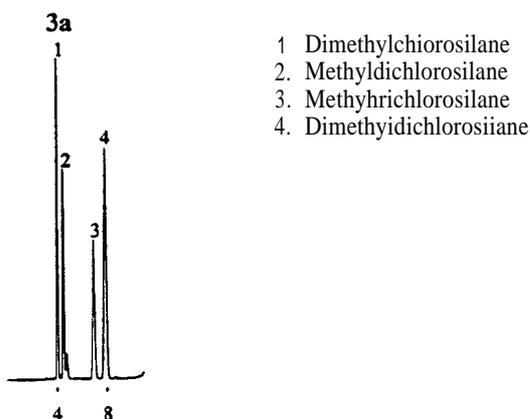
Due to improvements in thermal stability, bleed, and inertness, the Rtx-200 is ideal for the analysis of a wide variety of compounds. Some new, novel applications for the Rtx-200 include free fatty acids, chlorosilanes, glycols, and alkyl

nitrites. We previously published applications chromatograms on Freon & polar solvents, phenols, and polynuclear aromatic hydrocarbons (The Restek Advantage July 1991).

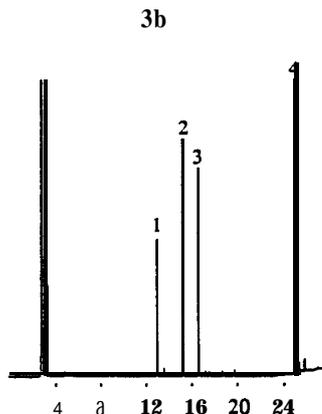
## Free Fatty Acids

The inertness and selectivity of the Rtx-200 makes it ideal for the analysis of volatile free fatty acids. Figure 2 shows the analysis of nine common fatty acids on a 30m, 0.25mm ID, 0.25um Rtx-200 column. All components are virtually

Figures 3a & b - Thick film Rtx-200's are ideal for the analysis of volatile chlorosilanes.



1. Dimethylchlorosilane
2. Methylchlorosilane
3. Methyltrichlorosilane
4. Dimethyltrichlorosilane

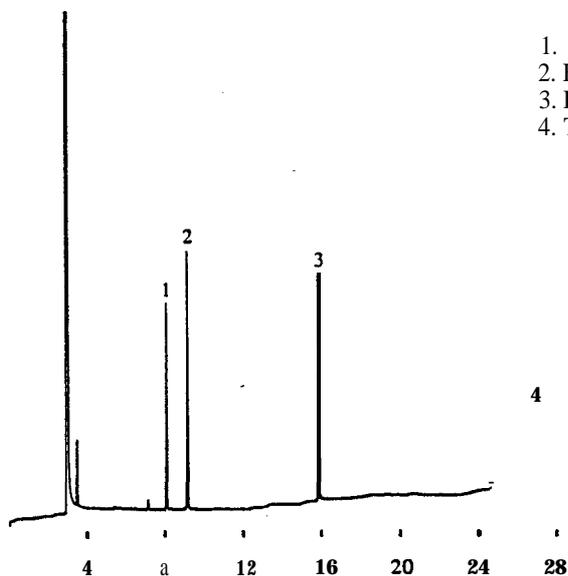


1. Phenylchlorosilane
2. Methylphenylchlorosilane
3. Phenylvinylchlorosilane
4. Diphenyl chlorosilane

60m, 0.53mm ID, 3.0µm Rtx-200 (cat.# 15088)  
 0.5-1 split injection of methyl chlorosilanes  
 Concentration approximately 250ng/oncolumn  
 Oven temp.: 40°C (hold 9 min.) to 250°C @ 15°C/min. (hold 5 min.)  
 Inj. temp.: 200°C Det. temp.: 250°C  
 Carrier gas: Hydrogen  
 Linear velocity: 40cm/sec. (flow rate: 5.2cc/min.)  
 HP FID sensitivity: range=2, attn.=5  
 Split vent: 90cc/min.

60m, 0.53mm ID, 3.0µm Rtx-200 (cat.# 15088)  
 0.2µl split injection of phenyl containing chlorosilanes  
 Concentration approximately 100ng/on-column  
 Oven temp.: 60°C to 270°C @ 15°C/min. (hold 8 min.)  
 Inj. temp.: 200°C Det. temp.: 270°C  
 Carrier gas: Hydrogen  
 Linear velocity: 40cm/sec. (flow rate: 5.2cc/min.)  
 HP FID sensitivity: range=2, attn.=5  
 Split vent: 90cc/min.

Figure 4 - Analyze glycols without tailing on an Rtx-200 column.



1. Propylene glycol
2. Ethylene glycol
3. Diethylene glycol
4. Tetraethylene glycol

60m, 0.53mm ID, 3.0µm Rtx-200 (cat.# 15088)  
 1.0µl split injection of glycols  
 Concentration approximately 50ng/on-column  
 Oven temp.: 40°C to 250°C @ 8°C/min. (hold 15 min.)  
 Inj. temp.: 200°C Det. temp.: 250°C  
 Carrier gas: Hydrogen  
 Linear velocity: 40cm/sec. (flow rate: 5.2cc/min.)  
 FID sensitivity: 6.4 x 10<sup>-11</sup>APS  
 Split vent: 90cc/min.

baseline resolved in less than three minutes with excellent peak symmetry.

### Chlorosilane Analysis

Analysis of chlorosilane monomers on trifluoropropyl capillary columns has been hampered by the limited film thicknesses available. With film thicknesses up to 3.0µm, the Rtx-200 columns are ideal for the analysis of low molecular weight chlorosilanes. Figures 3a and 3b show the analysis of both methyl and phenyl chlorosilanes on a 60m, 0.53mm ID, 3.0µm Rtx-200. The unique selectivity of the Rtx-200 combined with the increased film thickness results in baseline separation of these volatile chlorosilanes.

### Glycols

The excellent inertness of the Rtx-200 allows active compounds to be analyzed without tailing or adsorption. Figure 4 shows the analysis of several glycols on a 60 meter, 0.53mm ID, 3.0µm Rtx-200 column. Even at the 50ng level, these reactive components exhibit sharp, symmetrical peaks.

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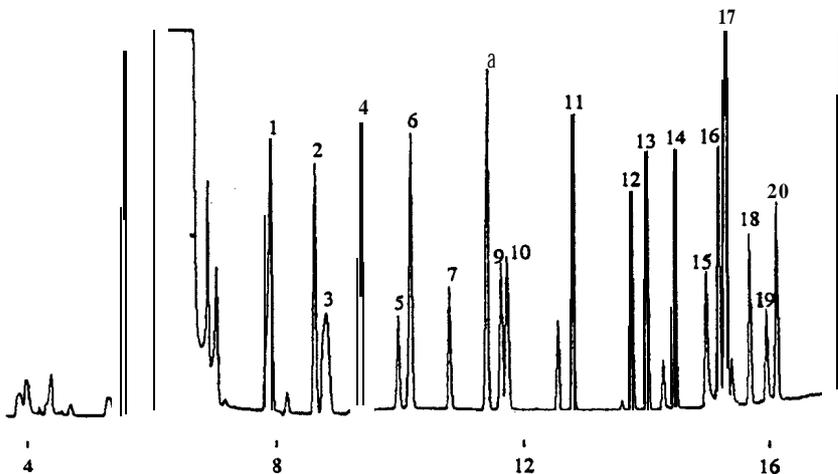
### Alkyl Nitrates and Halocarbons

Figure 5 shows the analysis of a complex mixture of alkyl nitrates and halocarbons on a 60m, 0.25mm ID, 1.0um Rtx-200. The inertness and low bleed of the Rtx-200 allow trace level analysis of these compounds using an Electron Capture Detector. The Rtx-200 provides excellent separation in less than 40 minutes.

The Rtx-200 is a highly selective stationary phase that is ideal for many types of analyses. Because of its unique polarity and high thermal stability, the Rtx-200 is an excellent confirmational column. The 360°C maximum operating temperature, low bleed, and excellent inertness gives analysts an alternative to other intermediate polarity capillary columns. Available in a wide range of film thicknesses and diameters, the Rtx-200 may be the solution to your difficult analytical separations.

Figure 5 - Unique selectivity of the Rtx-200 resolves Alkyl Nitrates and Halocarbons.

- |                         |                      |                           |
|-------------------------|----------------------|---------------------------|
| 1. ethyl nitrate        | 8. dibromopropane    | 15. ethyl-hydmyx & ate    |
| 2. dibromochlorometbane | 9. isobutyl nitrate  | 16. n-pentyl nitrate      |
| 3. carbon tetrachloride | 10. 2-butyl nitrate  | 17. hexachloroetbane      |
| 4. isopropyl nitrate    | 11. n-butyl nitrate  | 18. 3-hexyl nitrate       |
| 5. ethylene dibromide   | 12. 3-pentyl & ate   | 19. propyl-hydroxy nittwe |
| 6. n-propyl nitrate     | 13. 2-pentyl nitrate | 20. 2-hexyl nitrate       |
| 7. methylene bromide    | 14. isoamyl nitrate  | 21. dibromochlomppane     |



60m, 0.25mm ID, 1.0um Rtx-200 (cat.# 15056)  
 15pg/pl alkyl nitrate & halocarbon standard  
 Oven temp.: 85°C (hold 7 min.) to 225°C @ 12C/min.  
 Detector: ECD

courtesy of Dr. **Elliot Atlas** National Center for Atmospheric Research

length	df	0.25mm ID	0.32mm ID	OiSJmmIJ
15 meter	0.10	15005	15006	15007
	0.25	15020	15021	15022
	0.50	15035	15036	15037
	1.00	15050	15051	15052
	1.50		15066	15067
	3.00			15082
30 meter	0.10	15008	15009	15010
	0.25	15023	15024	15025
	0.50	15038	15039	15040
	1.00	15053	15054	15055
	1.50		15069	15070
	3.00			15085

length	df	0.25mm ID	0.32mm ID	0.5mm ID
60 meter	0.10	15011	15012	15013
	0.25	15026	15027	15028
	0.50	15041	15042	15043
	1.00	15056	15057	15058
	1.50		15072	15073
	3.00			15088
105 meter	0.10	15014	15015	
	0.25	15029	15030	
	0.50	15044	15045	
	1.00	15059	15060	
	1.50		15075	
	3.00			15091

length	df	0.25mm ID	length	df	0.18mm ID	length	df	0.18mm ID
10-meter	0.20	45001	20 meter	0.20	45002	40 meter	0.20	45003
	0.40	45010		0.40	45011		0.40	45012