

# Suppressors

## Carbonate Removal Device 200 (CRD 200) for RFIC-EG Systems



*Since the introduction of eluent generation, hydroxide eluents have become synonymous with ease-of-use and performance. However, in some samples, the presence of high levels of carbonate originating from dissolved carbon dioxide from the air can interfere with the accurate determination of certain analytes of interest. The Carbonate Removal Device 200 for RFIC-EG™ systems (CRD 200) is a device that is used to remove the carbonate peak.*

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The CRD 200 is installed between the suppressor and the conductivity detector cell. This placement reduces the carbonate peak contributed by the sample during anion analysis by suppressed ion chromatography.

- The CRD 200 provides the following:
- Removal of carbon dioxide in the sample using hydroxide eluent
  - Improved integration and quantitation of some analyte peaks, such as sulfate, that elute close to carbonate

For optimal performance, Dionex recommends using the CRD 200 with a Reagent-Free™ Ion Chromatography (RFIC™) system equipped with an Eluent Generator and EGC, Continuously Regenerated Anion Trap Column (CR-ATC), and a hydroxide eluent compatible column (such as IonPac® AS11, AS11-HC, AS15, AS16, AS17, AS18, AS19, AS20, or AS21). The CRD 200 can also be used with RFIC systems pursuing borate chemistry with IonPac AS4A, AS14, or AS14A chemistries.



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## Solutions to Analytical Challenges

By simply being exposed to carbon dioxide in the air, samples can become contaminated with carbonate. In some samples, depending on the column and separation conditions, the presence of high levels of carbonate originating from dissolved carbon dioxide can interfere with the accurate determination of analytes of interest such as sulfate and nitrite. Under these conditions, minimizing carbonate leads to improved quantitation.

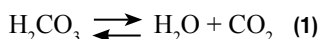
### The CRD 200 offers:

- Improved peak integration and quantitation for analytes such as sulfate, chloride, or nitrite in hydroxide and borate based RFIC systems.

### CRD 200 Design and Operation

The CRD 200 consists of a gas permeable membrane that has a silicone coating selective to CO<sub>2</sub> (Figure 2). The CRD 200 is plumbed between the suppressor module and the detector cell. The regenerant channel that encloses the CRD 200 membrane is flushed with the suppressor waste (base) and aids in the removal of the CO<sub>2</sub> as carbonate.

The CRD 200 removes the carbonate peak as CO<sub>2</sub> from the suppressed eluent as per the following equilibrium.



As the CO<sub>2</sub> peak is removed by the CRD 200 membrane, the equilibrium shifts to the right facilitating further removal of CO<sub>2</sub>. Additionally, the basic environment in the regenerant channel allows a quick conversion of the removed CO<sub>2</sub> to carbonate anion. The net result of these steps is a significant reduction of the carbonate peak.

The CRD 200 can remove high levels of carbonate (> 1000 mg/L of carbonate with > 90% removal efficiency\*). It should be noted that high levels of CO<sub>2</sub>/carbonate in the sample may affect chromatographic peak shapes and recovery.

The above equation typically underestimates the true CO<sub>2</sub> removal efficiency

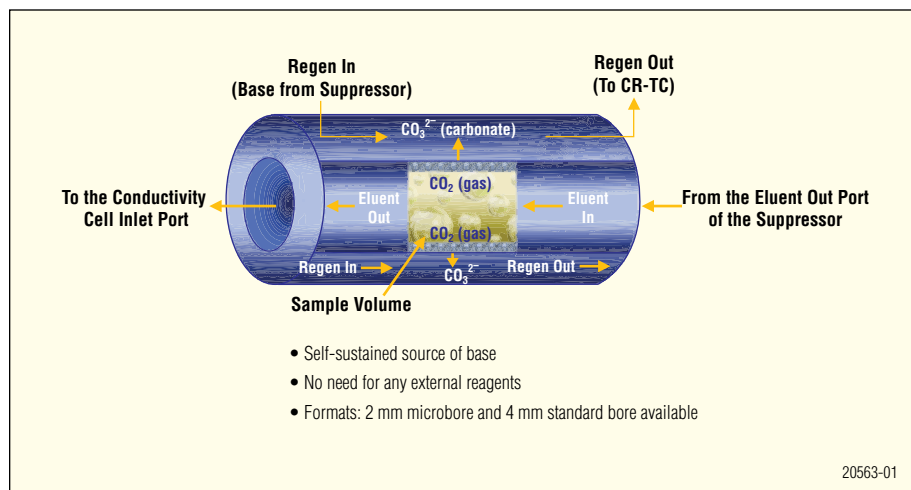
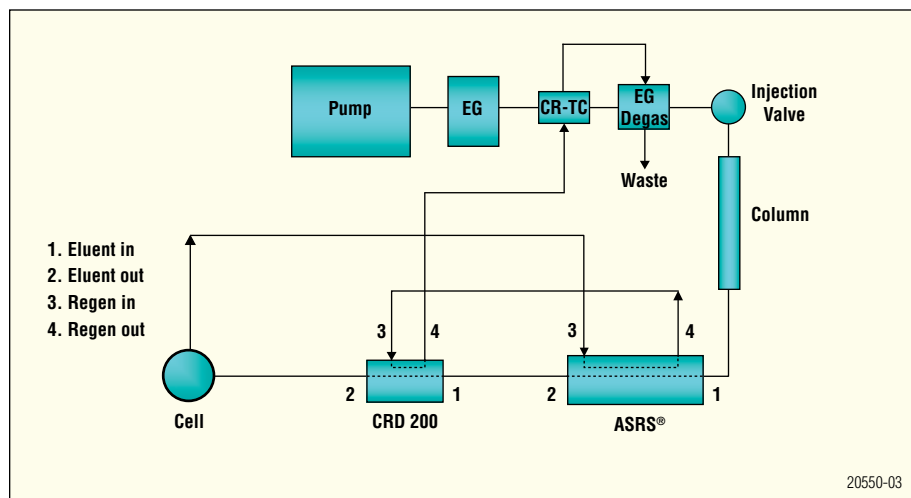


Figure 2. Carbonate Removal Device 200 (CRD 200) design and operation.

\*Removal efficiency is defined here as:

$$\% \text{ Removal Efficiency} = \left[ 100 - \left( \frac{\text{Response}_{\text{w/CRD}}}{\text{Response}_{\text{w/oCRD}}} \times 100 \right) \right] \quad (2)$$

Response<sub>with CRD</sub> = Peak area with CRD 200 installed  
Response<sub>without CRD</sub> = Peak area without the CRD 200 installed

based on the chemical equilibrium outlined in equation (1). For example, when a peak of height 23 μS/cm is reduced to 2.3 μS/cm, the true removal efficiency based on the chemical equilibrium described in equation (1) is calculated as 99%, whereas the removal efficiency calculated using equation (2) is 90%.

### System Compatibility

The CRD 200 can be installed easily in any Dionex ion chromatograph equipped with an Eluent Generator, CR-ATC, and ASRS® 300 or ACES 300 suppressor, and requires no reagents or software control. It is a low-dispersion device designed specifically for use with hydroxide-based and borate-based chemistries using the Dionex IonPac® AS21, AS20, AS19, AS18, AS17, AS16, AS15, AS14A, AS14, AS4A, AS11, and AS11-HC columns. The CRD 200 product is available in standard-bore (for 4 and 5 mm columns), microbore (for 2 and 3 mm columns), and capillary (for capillary columns) formats.

## Recommended Applications

The CRD 200 is recommended for both routine and trace level work with hydroxide and borate eluents when the presence of CO<sub>2</sub>/carbonate from the sample interferes with the anion analytes of interest, such as sulfate and nitrite. Under these conditions, minimizing carbonate using the CRD 200 leads to improved peak integration and quantitation for analytes such as sulfate and nitrite in hydroxide RFIC systems. The CRD 200 is particularly useful for analyzing drinking water, groundwater, wastewater, ultrapure water, and caustic solutions where carbonate is a major component in the samples, especially when pursuing large-volume injections or preconcentration techniques.

A typical anion application at ppb level is shown in Figure 3 demonstrating the utility of the CRD 200 to remove CO<sub>2</sub> and improve the quantitation of sulfate.

Analysis using borate eluents is typically pursued in the nuclear power industry for analyzing borated waters. As shown in Figure 4, the CRD is useful in reducing the CO<sub>2</sub> peak and improving the quantitation of chloride.

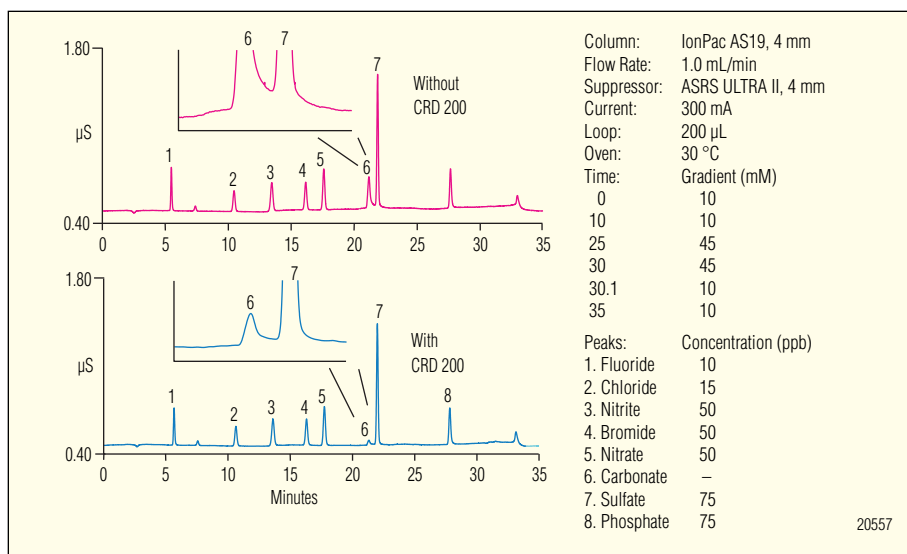


Figure 3. Anion separation showing the expected reduction of the interfering carbonate after the CRD 200 is installed, facilitating improved sulfate quantitation.

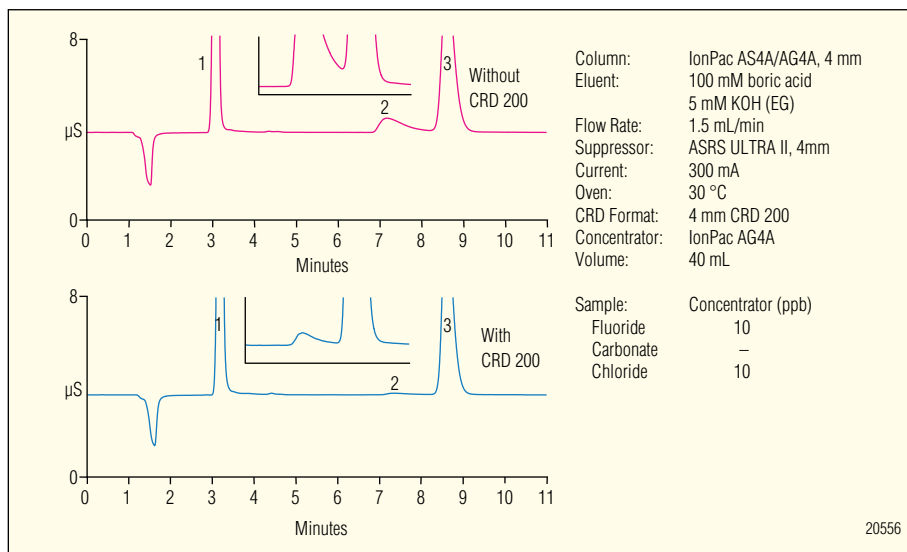


Figure 4. CRD 200 with AS4A borate chemistry showing improved integration of chloride after reduction of the carbonate peak.

## Summary

The benefits of RFIC using hydroxide eluent generation are well documented. The CRD 200 Carbonate Removal Device is new technology that minimizes the interference from carbon dioxide in samples. The CRD 200 reduces the carbonate peak in the chromatographic separation, thereby improving peak integration and quantitation for analytes such as sulfate, chloride, or nitrite.

## CRD 200 Configurations

The CRD 200 is available in 2 mm, 4 mm, and capillary formats for use with capillary, 2, 3, 4, and 5 mm ion chromatography columns. The 4 mm CRD 200 has a typical delay volume of 200  $\mu$ L and is recommended for 4 or 5 mm column applications. The 2 mm CRD 200 has a typical delay volume of 40  $\mu$ L and is recommended for 2 or 3 mm column applications. The capillary CRD 200 has a typical delay volume of 2  $\mu$ L and is recommended for capillary column (< 1 mm) applications.

## CRD SPECIFICATIONS

### Hardware Dimensions ( $h \times w \times d$ ):

#### CRD 200 (2 mm and 4 mm):

2.0 cm  $\times$  4.4 cm  $\times$  7 cm  
(0.8 in  $\times$  1.7 in  $\times$  2.8 in)

#### CRD 200 (Capillary):

11.3 cm  $\times$  9.3 cm  $\times$  2.1 cm  
(4.5 in  $\times$  3.7 in  $\times$  0.8 in)

### Void Volume:

CRD 200 (2 mm) ~40  $\mu$ L  
CRD 200 (4 mm) ~200  $\mu$ L  
CRD 200 (Capillary) ~2  $\mu$ L

## ORDERING INFORMATION

To order, using the following part numbers, contact your local Dionex office or distributor nearest you. In the U.S., call (800) 346-6390. In other regions, refer to the phone numbers below.

Description	Part Number
CRD 200 (4 mm) Carbonate Removal Device.....	062983
CRD 200 (2 mm) Carbonate Removal Device.....	062986
CRD 200 (Capillary) Carbonate Removal Device .....	072054

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Denmark (45) 36 36 90 90 France (33) 1 39 30 01 10 Germany (49) 6126 991 0  
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