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Application News

CGT-7100 Portable Gas Analyzer

Using the CGT-7100 to Analyze Carburizing Furnace Atmosphere

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User Benefits

- Portable design with built-in sample gas pretreatment functions and sampling pump, allowing for easy analysis in any location.
- Uses the same non-dispersive infrared absorption technique as continuous gas analyzers to collect highly compatible data.
- Data is stored in USB flash drive convenient for editing on a computer or sharing between departments.

■ Introduction

Gears and other mechanical components that bear heavy loads are put through a heat treatment process called carburization to improve their resistance to wear and fatigue. Carburization increases the hardness of the outer surface of the component while maintaining the ductile structure (toughness) of its core.

Heat treatment is performed in a carburizing furnace where the low-carbon steel component absorbs carbon (carburizes) into its outer surface before a quenching step. The atmosphere inside a carburizing furnace is regulated based on its carbon potential (CP), where real-time analysis and feedback control based on that analysis are essential for accurate and automated furnace operation.

This article describes using the CGT-7100 portable gas analyzer to measure CO and CO_2 in the atmosphere of a drip-fed gas carburizing furnace (Fig. 1).

We used a carburizing furnace with a Shimadzu NSA-308 continuous gas analyzer (Fig. 2) that measures furnace atmosphere CO and CO_2 in real time. This data is used to calculate CP, which is used for fully automated regulation of the furnace atmosphere. This article does not describe measuring CO and CO_2 when the furnace is under fully automated control but describes measuring the change in atmosphere CO and CO_2 during a preparatory step[*1] in the carburizing process as methanol is drip-fed into the furnace.

■ Measurement Method

A sampling pipe (external diameter 8 mm × internal diameter 6 mm, PTFE pipe) was connected from the CGT-7100 to the outlet on the filter of the NSA-308 sample pretreatment unit, where the NSA-308 continuous gas analyzer is located adjacent to the carburizing furnace. Samples were collected using the CGT-7100 built-in pump (Fig. 3). Measurement conditions are shown in Table 1.

Fig. 2 Drip-Feed Gas Carburizing Furnace

Fig. 1 Shimadzu NSA-308 Continuous Gas Analyzer

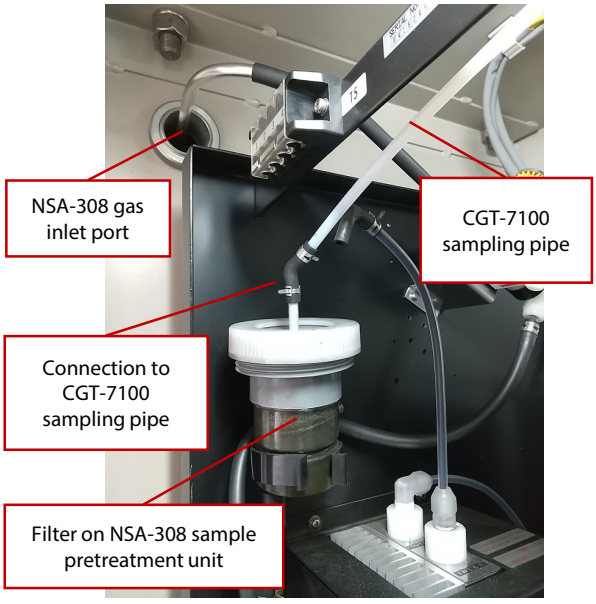

Fig. 3 View of Connection to CGT-7100 Sampling Pipe (inside NSA-308)

[*1] During this step, methanol is added directly to a nitrogen-filled furnace at carburizing temperatures, and carburizing gas (CO) is generated by thermal decomposition of methanol.

Table 1 Measurement Conditions

Analyzer:	CGT-7100
Measured components and ranges:	CO 50 vol%, CO_2 5 vol%
Sampling flowrate:	2.5 L/min
Other:	Built-in pump used for sampling

■ Measurement Results and Discussion

Fig. 6 shows furnace atmosphere CO and CO_2 measurements taken by the CGT-7100. As methanol is drip-fed into the furnace and undergoes degradation, CO gradually increases in concentration to approx. 26 vol% in 70 minutes. The carburizing furnace starts to automatically regulate the process atmosphere at this CO concentration, and indicates that the preparatory step is complete.

These measurements demonstrate the relationship between CO and CO_2 levels in the furnace and the volume and duration of methanol drip feeding, and show the CGT-7100 can be used to study operating conditions and to investigate problems in a drip-feed gas carburizing furnace.

Fig. 4 CGT-7100 Window during Use

■ Conclusion

The CGT-7100 collects highly compatible data by using the same non-dispersive infrared absorption technique as continuous gas analyzers in widespread use. As a result, the CGT-7100 can be used to inspect continuous gas analyzers, as a backup for a continuous gas analyzer, or the portability and simplicity of the CGT-7100 can be utilized in a more flexible role to take furnace atmosphere measurements from different parts of a carburizing furnace. The CGT-7100 also has built-in sample gas pretreatment functions and a sampling pump that preclude the need for external accessories.*2

As well as the carburizing furnace described in this article, we hope that Shimadzu's portable gas analyzer will be used in other applications requiring gas analysis of an enclosed atmosphere, such as other types of atmosphere furnace, gloveboxes, and environmental chambers for materials testing.

Fig. 5 View of CGT-7100 Taking Atmosphere Measurements from a Carburizing Furnace

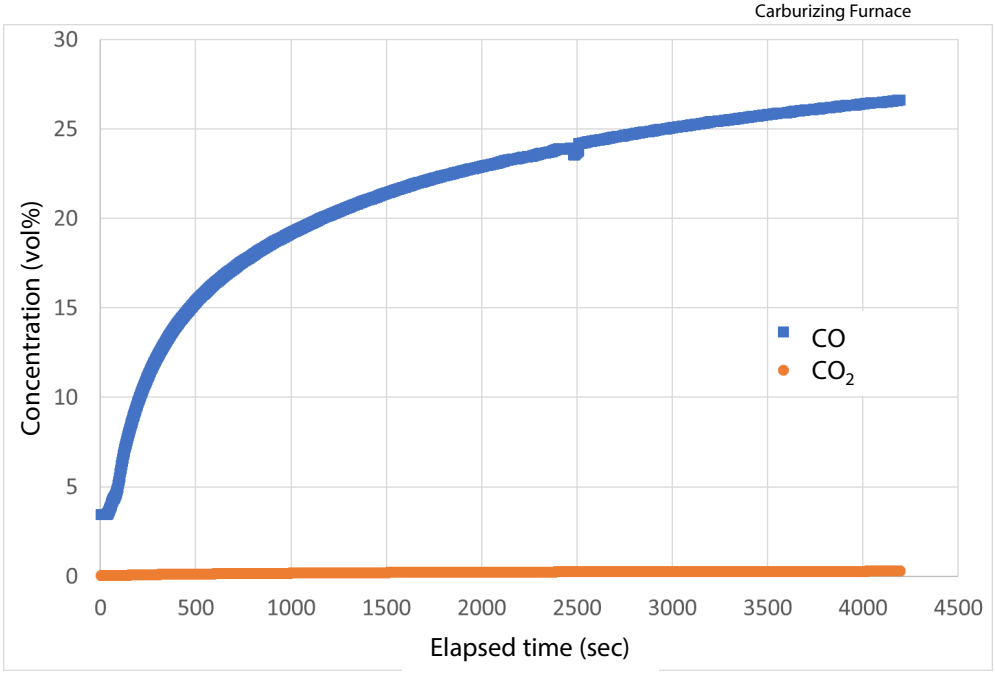

Fig. 6 Carburizing Furnace Atmosphere CO and CO_2 Measurements Taken by CGT-7100

*2 Dependent on measurement conditions. Contact a Shimadzu representative for further details.

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