



Tokyo Electron

# KT Methods Guide Customer Support of Semiconductor Manufacturing Process

## SCORECARD

- Increased customer satisfaction
- Faster issue resolution
- Added value for the customer
- Reduced time/cost for providing support

Tokyo Electron Ltd (TEL) is a global company that engineers, manufactures, sells, and services semiconductor production equipment, flat panel displays, and electronic components and networks. A major part of the semiconductor manufacturing process is photolithography, the transfer of pattern/structures onto the surface of silicon wafers using a coater/developer such as TEL's Clean Track system.

For quality control of this process, two key measures are taken on the face of the wafers: defects measure identify particles, residues or other foreign objects that should not be on the wafer; and critical dimensions (CD) measures verify proper transfer of the pattern/structures. If these critical measures are out of target, troubleshooting is performed to find cause.

**CHALLENGE:** A customer using TEL's Clean Track system on two production lines struggled to find cause when problems arose. Efforts were often poorly documented, key data was not interpreted, and root cause was often found by process of elimination, which could take days. In fact one problem had interfered with production for eight days, costing at least \$20,000 in parts and labor. TEL was asked to help find cause to why one of the CD measurements was out of target at the center location on the silicon wafer.

**SOLUTION:** Product Specialist Neil Bradon and other key management and engineering staff members in TEL Europe were trained to use and facilitate KT Problem Solving & Decision Making. The training was part of a strategic, global initiative that is targeting improved problem solving in the service operation using KT training, business process integration, and ongoing support in five languages. The CD problem provided the first opportunity for Neil to "go live" using KT processes.

*(continued)*

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## SUMMARY OF THE PROBLEM ANALYSIS PROCESS:

### Describe Problem

State the problem

*What has the deviation? What is the deviation? What do we see, hear, feel, taste, or smell that tells us there is a deviation?*

### Specify the problem

	IS	IS NOT
WHAT	<i>has the deviation? is the specific deviation?</i>	<i>could have, but does not? other possible deviations but are not?</i>
WHERE	<i>is the object? is the deviation on the object?</i>	<i>else could the object be, but is not? else could it be on the object, but is not?</i>
WHEN	<i>was the deviation first observed? since that time has it been seen (pattern)? in the object's history or life cycle seen first?</i>	<i>else could it have been first observed, but was not? since could it have been observed, but was not? else could it have been observed, but was not?</i>
EXTENT	<i>How many objects have the deviation? What is the size of a single deviation? How many deviations are on each object? What is the trend?</i>	<i>How many could have, but do not? What size could it be, but is not? How many deviations could we have, but are not? What could be the trend, but is not?</i>

### Identify Possible Causes

Use knowledge and experience to develop possible cause statements *(often beneficial to examine distinctions and changes first)*

Use distinctions and changes to develop possible cause statements *(not necessary for "Extent")*

### Evaluate Possible Causes

Test possible causes against the IS and IS NOT specification *(record "Only if" qualifiers)*

Determine the most probable cause

### Confirm True Cause

Neil advised the customer not to perform any invasive work until the problem was properly defined and causes identified. After completing the problem statement—CD measurement on Product A and B is out of spec—he described the problem using the IS and IS NOT process to specify what, where, when, and the extent of the problem. To understand more, he asked distinctions and changes questions about what was odd, special, or unique about the IS compared to the IS NOT. This prompted him to gather specific data and measure CD across the center of the wafer.

Questioning revealed that the problem had developed earlier than first suspected. In fact, it first arose 16 months earlier when a process deviation on the edge of the wafer had prompted the introduction of a new developer process recipe. The new recipe had been introduced on all products but never optimized. When the old recipe was tested, the center measurement returned to spec. The troubleshooters successfully extended the analysis to identify why the problem did not appear in the other products and why every wafer had not measured out-of-spec. Although recipe optimization was not part of the normal scope of work, TEL helped optimize the developer process recipe across the wafer, providing added value to the customer and resolving the outstanding CD issue.

**RESULTS:** Although the problem had existed for 16 months, testing at the end of the production line had not revealed any problems and quality was maintained. The rapid solution of the CD issue built customer satisfaction and provided additional value to the customer while helping TEL reduce the time and associated costs of providing support. As KT processes are introduced across factories and business areas, TEL is benefiting from consistent procedures, a common approach, and more effective communication.