Reliable Chip & Burr Detection

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Internal burr at crosshole

Introduction

Resec Systems has been a leader in the manufacture of automated optical inspection equipment since the mid 1990's. These machines offer a unique combination of high speed, accuracy, ease of use and flexibility which has helped solve many quality control issues for the precision part manufacturing community.

Through the years, the community has demonstrated a need to inspect product not just for mechanical tolerances and presence/absence of features, but also for the detection of undesired chips and burrs on the parts.

The Challenge

The challenge is that the size, geometry, and location of the chips or burrs are usually unknown, making it difficult to set up and program any system for reliable detection.

Because normal optical systems basically operate on light reflections entering the camera, these inconsistencies make it virtually impossible to position the camera and lighting such that no matter where the chip is it will generate a detectable reflection.

In many cases, the difference in the images with and without chips is less than the variation among parts without chips, making the programming of these devices very difficult if not impossible.

Our Solution

We have studied the issue at length and are able to divide the problem into four basic categories:

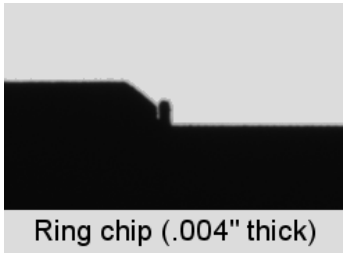
1a. Chips wrapped around the external areas of a part.
1b. Chips lodged inside the smallest ID of a part.

2a. Chips lodged in blind holes.
2b. Chips lodged in internal steps or shoulders.

3. Chips, Burrs, or debris only visible partially around the part.

4a. Chips or burrs that are totally obscured, such as lodged in an internal groove.
4b. Chips or Burrs that do not fit the 3 above categories.

Chips that fall into category 1 can easily be detected using backlight illumination to create a shadow of the part's profile (1a) or the part's top view (1b). ShadowGage now includes an advanced contour tool that expands the silhouette of a part without chips and then looks for obstructions on the silhouette.

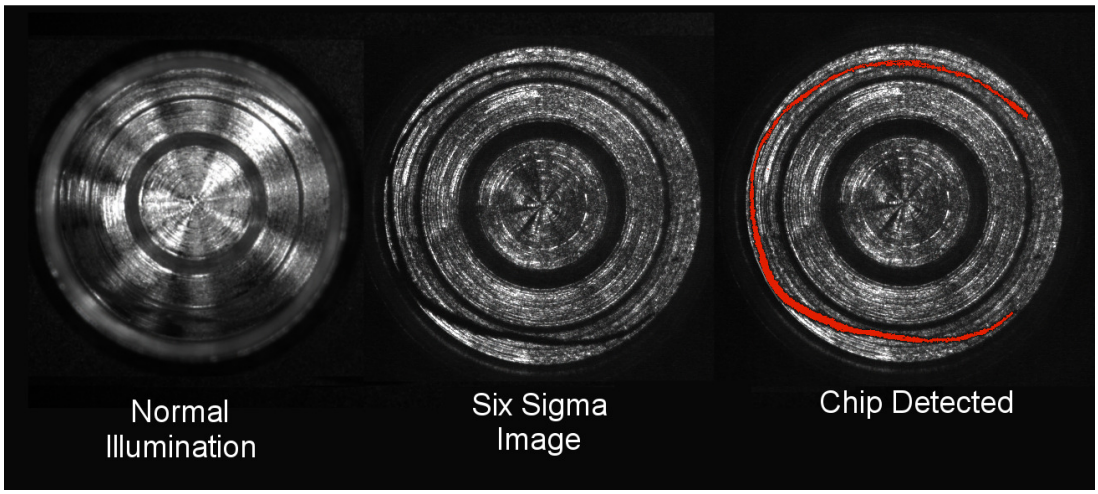


Category 1 chips can be detected with a single exposure, resulting in high inspection rates.

Chips in category 2 cannot be reliably detected with normal lighting techniques because the reflections are not consistent.

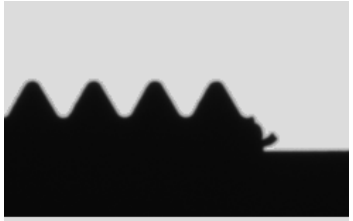
Six Sigma Concepts, LLC has developed an optical technology that creates an extraordinary contrast level between chips and the machined surface they obstruct. Images from machined metallic surfaces generally have normal variations that are greater than what a typical chip would add, therefore inspection is challenging for

machine vision with traditional lighting. The high contrast that Six Sigma offers allows for highly reliable chip detection in blind holes and stepped shoulders.

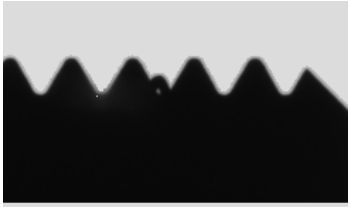


Chips in Category 2 can also be detected with a single exposure, resulting in high inspection rates.

Chips and Burrs in category 3 require either multiple cameras or rotating the part and taking images during the rotation cycle, since the position of the chip or burr is not known. These defects can also be detected using ShadowGage's advanced contour tool.



Burr at end of thread



Debris or chip on thread

Chips and Burrs in category 3 require multiple exposures, somewhat reducing the inspection rate.

Chips and burrs in category 4 may not be detectable by optical means.

Equipment Capabilities

Resec Systems manufactures several sorter models, each with its unique characteristics and the ability to transport various part geometries and sizes.

The following table shows the equipment required to detect the various chip categories and the associated speed.

	Model J194	Model J194C	Model J197	Model J198	Model J198C
Cat 1	**yes**	**yes**	**1a only**	**1a only**	**yes**
Cat 2		**yes**			**yes**
Cat 3				**yes**	**yes**
Max Rate	**10,000 pph**	**10,000 pph**	**7,000 pph**	**1,800 pph**	**1,800 pph**

A brief description of each model follows:

	Transport	Part Motion	Camera View	Exposure
Model J194	**Horizontal Platen**	**Part travels perpendicular to its centerline**	**Profile & Top View**	**Single Image (2D)**
Model J197	**Tilted Platen**	**Part travels parallel to its centerline**	**Profile Only**	**Single Image (2D)**
Model J198	**Rotary Stage**	**Part rotates about its centerline**	**Profile Only**	**Multiple Images (3D)**
C - Suffix	**Six Sigma System**		**Top View**	**Single Image (2D)**