



GAS GRILL PLASTIC NUT FAILURE

ESI conducts complex multidisciplinary product analysis to determine the root cause of a failure leading to the ignition of a fire.

SITUATION

ESI was hired to investigate the cause of an alleged unintended ignition of propane gas, causing burn injuries to the plaintiff, who was attempting to use his gas grill at the time of the incident. The plaintiff had used the grill regularly for over a decade with no apparent issues. He opened the portable propane tank valve, lit the grill to pre-heat it, went to the kitchen to retrieve the food, and noticed a low flame upon returning to the grill. He turned off the grill, re-lit it, and still noticed low flames. At this point, he bent down and opened the cabinet housing the tank and noticed a hissing sound shortly before a flash fire ignited.

Upon investigating the grill at the scene, it was noted that the plastic nut connecting the tank to the grill was cracked in several places. The grill, tank, and connector components were collected for a multi-party investigation at ESI-Dallas. Dr. Amy Gray, a mechanical engineer and CFEI in the Fire Science Practice Group, and Dr. Rick Baron, a metallurgical engineer in the Materials Practice Group, investigated this incident.

Practices: Fire & Explosion
Materials Science

ESi Consultants

Amy E. Gray, Ph.D., P.E.
Senior Managing Consultant
Manager of Miami Operations
aegray@engsys.com
305.599.2262

Richard P. Baron, Ph.D., P.E.
Principal and Director, Materials
rpbaron@engsys.com
214.343.3811

Services Utilized

- Computed Tomography (CT Scanning)
- Microscopic Inspection
- SEM
- Engineering Analysis
- Exemplar Testing
- Fire Origin & Cause Determination

About ESI

For over 30 years, ESI has leveraged its multidisciplinary team of engineers, scientists, and professional technical staff to investigate many major accidents and disasters. Our technical expertise, hands-on experience and state-of-the-art facilities, combined with diagnostic, analytical and physical testing capabilities create an ideal environment for quickly identifying and interpreting the facts of a case.

Contact ESI

For more information visit our website or call us toll free at 866.596.3994.

www.engsys.com

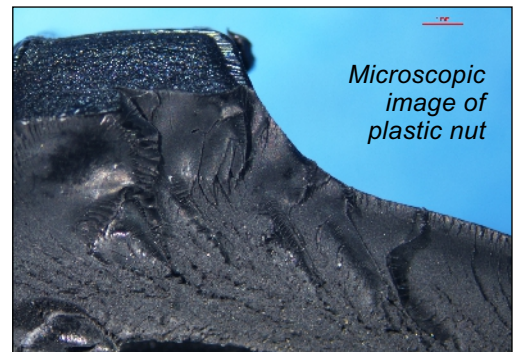
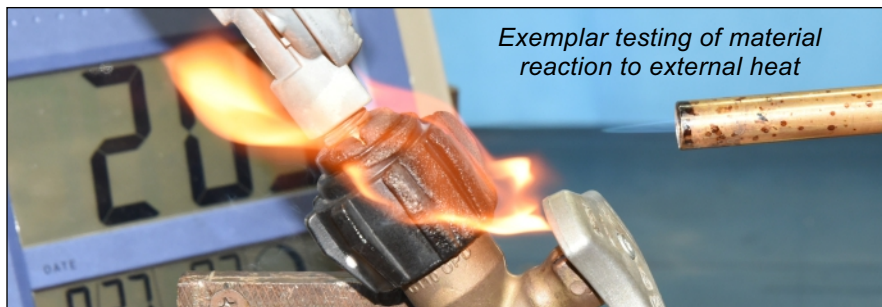
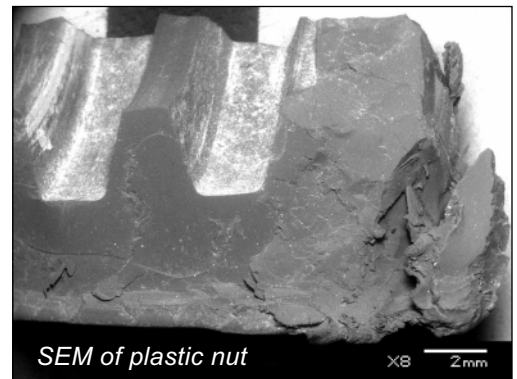
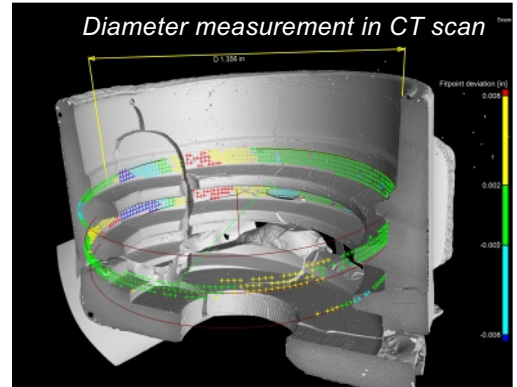
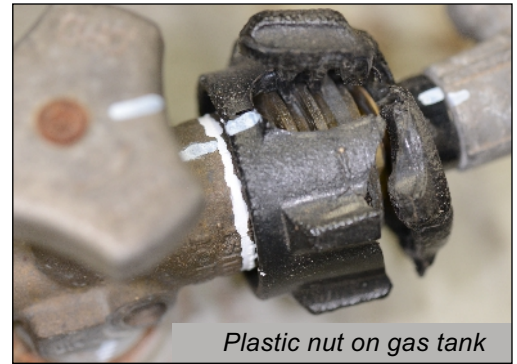
SOLUTION

This investigation began with a multi-party site inspection of the grill and collection of the grill and tank by ESI. A multi-party laboratory inspection was held at ESI-Dallas, where CT scanning of the tank-regulator interface was conducted before disassembly. Once disassembled, the regulator-hose components (including the plastic nut and brass spud) were inspected using stereo and scanning electron microscopy. Fracture features and crack progression were analyzed on the plastic nut during this step. Further CT scanning of the separated components was also conducted. Investigation of the tank revealed that it had functioned properly during the incident.

Throughout ESI's continued investigation, several exemplar regulator-hose assemblies from the same unique manufacturer were painstakingly found and collected for comparison to the subject regulator. During the comparison process, high-precision measurements of various features were made using the CT scans. These measurements were also compared to the dimensions specified for a propane tank regulator connection nut under the CGA V-1 Standard. Additional testing was conducted to determine if the fracture pattern could have resulted from the use of a tool to tighten the plastic nut onto the propane tank. The effect of heat from an external fire on the properties of a plastic nut material was also studied to aid in fracture pattern interpretation.

RESULTS

ESI's investigation concluded that the cause of the incident was the progressive fracture of the plastic nut while installed on the brass tank valve, due to a slightly undersized nut. One other regulator-hose assembly manufactured at approximately the same time as the subject assembly was located and determined to have also been undersized. Assemblies manufactured in subsequent years appeared to have been correctly sized. At the time of the incident, the partially fractured nut still allowed for enough force to be placed on the internal tank check valve so that some gas flow was still possible both to the grill and, due to the fractured nut, into the cabinet under the grill. ESI's persistence, skill, and engineering capability ultimately resulted in a favorable settlement for the client.



WHY ESI. The Fire & Explosion and Materials Science practice groups are comprised of consultants with backgrounds in:

- Complex Fire Origin & Cause
- Fire Protection
- Product Fire Analysis
- Metallurgical Failure Analysis
- Explosion Origin & Cause
- Finite Element Analysis
- Fire Modeling
- Product Testing
- Fuel Gas Systems
- Chemical Analysis



Engineering Consulting
and Forensic Investigation

www.engsys.com