# Coursework

Causes of the failure of an object can be multifarious, one of which is creep. Creep is the tendency of a material to deform permanently under the action of stresses (Avner, 1985). The phenomenon of creep is time dependent and greatly sensitive to operating temperatures-creep increases with an increase in temperature. Widely disregarded and underappreciated, failure at recognizing the possibility of creep in a component or inadequate action to rectify creep may cause the failure of the material or the machine, rendering great financial loss in terms of output services/product. A few examples of failure caused by creep in the transportation industry are outlined below. Car engines encounter very high temperatures because of the burning of the fuel inside the combustion chamber. The exhaust gases coming out of the exhaust manifold are at a temperature of 500-1000oF, varying from engine to engine whereas the materials commonly used for the exhaust manifold are nickel based alloys, chrome steel or stainless steel in most cases. Significant creep occurs at temperatures of 828 K, 760. 9 K and 844. 3 K whereas the melting point of these materials is 1656 K, 1523 K and 1688 K respectively (Daniels, 2010). Deformation in the exhaust manifold of the engine not only results in a decrease in the volumetric efficiency of the engine but causes the engine to cease because of overheating and in extreme cases, might contribute to the failure because of deformation of other engine components like piston cylinder heads resulting in extreme wear and complete destruction of the engine altogether. However, such a situation is effectively avoided these days by carrying out creep tests and considering this phenomenon during the design of the engine. Another example of failure due to creep is in jet engines. Turbine blades in jet air craft rotate at a very high speed subjecting them to a large centripetal force, which causes acute stresses to be produced. To top the already extreme conditions, operating conditions of the jet engines is approximately 1673 K. Common materials used in turbine blades construction are nickel super alloys which have a creep temperature of 1655 K (Impress, 2009). Though resistant to creep even close to melting points, even slight amount of creep has to be avoided in the jet engines. Travelling at high speed, any sort of deformation can disturb the balance and efficiency of the air craft. A chipped off blade can wear off the entire engine (instantaneous destruction of engine), resulting in an aircraft crash. Thus, close check is kept on the dimensional tolerance and accuracy of the critical components of the jet engine. Fibre Glass is an important material in the construct of vehicle bodies like small cars because of its easy machinability, low cost and lighter weight. However, a point of concern is the life expectancy of this material under extreme conditions of high stresses and temperatures. This brings attention to failure of fibre glass because of creep. At higher temperatures, the fibre glass can soften and deform which is damaging in case of fire or when the exhaust manifold runs too close to the fibreglass body (Dave). Nevertheless, it is not a problem during the normal operating conditions where the temperature of the ambient goes as high as 310 K only whereas, the softening point of fibre glass is 1120 K and melting point is 1408 K (BGF Industries, 2004) . In all automobile vehicles, the engine comprises of a piston cylinder assembly converting reciprocating motion to rotary motion. The piston is lined with piston rings to form an air seal inside the cylinder. Moreover, it assists in cylinder lining lubrication and cooling. These piston rings are usually made of steel, nickel chrome alloys and the like. The operating temperature inside the combustion chamber of the vehicle may exceed 811 K (Know your car, 2011). Nickel chrome has a melting point of 1478 K with a creep temperature much below the melting point (Azom, 2010). In case the cooling system of the engine fails, the high temperature and stresses developed inside the engine causes deformation of the piston rings, resulting in extreme wear of the cylinder lining resulting in a steep drop in the engine efficiency. Incomplete combustion may take place, intake and exhaust of fuel and gases might be incomplete and in critical cases, the engine would require a complete over haul with changeover of the piston cylinder assembly. Through the aforementioned examples, the significance and deadly repercussions of creep failure have been highlighted. Thus it is established that creep tests and consideration of creep behaviour of a material should always be kept in mind during the design of a component/object in all engineering sectors, if not only transportation industry. Works Cited Avner Sidney H (1985). Introduction to Physical Metallurgy. 2nd ed. Delhi: McGraw Hill. 548-549. Azom. (2010). Nickel Chrome Alloys. Available: http://www. nickel-alloys. net/nickel_chrome_alloys. html. Last accessed 20th Feb 2011. BGF Industries. (2004). Fiberglass Cloth . Available: http://www. bgf. com/fiberglass_cloth/default. asp. Last accessed 20th Feb 2011. Daniels, Brian. (2010). High Temperature Fatigue of Engine Components - Virtual Design Validation of Exhaust Manifold . Available: http://virtualpowertrain. com/presentations/Safe%20Technology%20VPC%20Presentation/VPC_STL_Presentation. ppt.. Last accessed 20th Feb 2011. Dave. Chassis Basics 2 - Chassis Materials . Available: http://www. initialdave. com/cars/tech/chassisbasics02. htm. 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