



Adhesion, Friction, Fuel Oxidation, and Environmental Reactions: a Brief

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February 15, 2023

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Abstract

Friction, lubrication, supramolecular chemistry, and wear of mechanical machines have evolved carbon footprint globally for modulation of tribology energy dissipation. The economy is a function of cumulative mechanical work done by man and machine interface for fundamental investigation of environmental load evolved from tribos contacts. The 2nd law of thermodynamics is useful for explaining the shortage of Urban sink zone in the interpretation of sociotechnical indicators. The fourth-generation industrial revolution is a paradigm of socioeconomic sustainability at rubbing contact with automobiles.

Key words; Socioeconomy, Materials-energy balance, Thermodynamics, Carbon cytotoxicity

1. Introduction

The oxidative stress evolved from carbon footprints due to petroleum fuel energy expenditure in IC engines is a major environmental load overpopulated in cities in addition to the energy sector, industries, and buildings. Covid#19 political lockdown is a global challenge for modulation to negative carbon emissions as per the requirement of sustainable development goals SDGs promoted by the United Nations [1]. The achievement of the climate neutral world by mid-century by negative emissions for reducing global warming countries have decided to reach for rationalization of anthropogenic greenhouse gas emissions. The Paris Agreement is an international treaty on climate change ratified by 196 national parties at COP 21 in Paris, on 12 December 2015 to limit global warming below 2 degrees Celsius (preferably to 1.5 degrees Celsius) relative to pre-industrial levels, and entered into force on 4 November 2016 for ambitious target [2]. The Paris Agreement is a landmark political treaty in the multilateral climate change and a binding legal agreement adhere all nations to undertake cumulative political efforts to defeat global warming. The COVID-19 pandemic had a global potential on the environmental impact to achieve CO₂ negative emissions of as much as 7% for policy responses of the transportation sector specifically ground transportation or sustainable mobility transition [3]. The increases in greenhouse gas (GHG) concentrations are unequivocally evolved by anthropogenic activities to increase the mixed concentration in the biosphere such

as the amalgamation of molecules of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) reported by the summary of IPCC policymakers [4]. The author prepared an academic expression (Fig. 1) by researching during the SARS-CoV-2 pandemic and post-pandemic era with reference to tribology, carbon footprints, and mechanical efficiency in the man/machine domain.

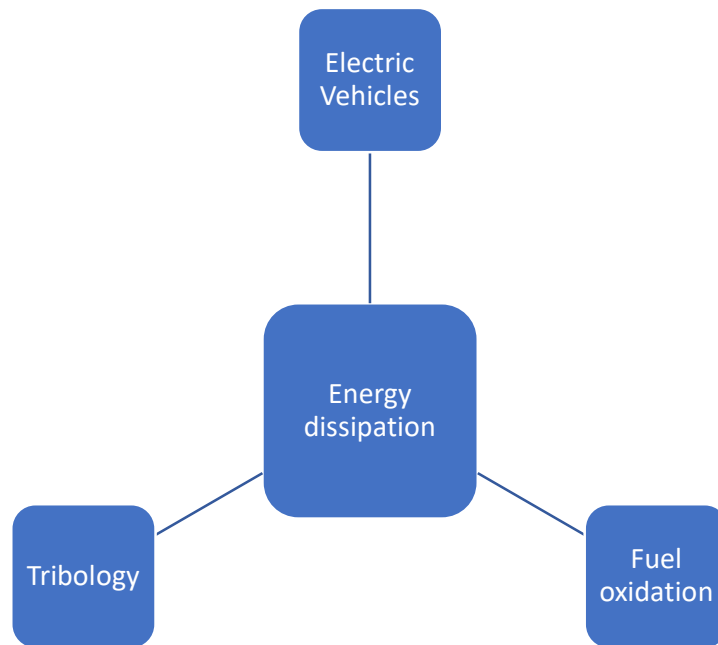


Fig. 1 Fundamental expression of energy dissipation at dynamic mechanical contacts of urban mobility in a spectrum SDGs

2. Electroadhesion and friction

Friction, lubrication, and wear at rubbing contacts of automobiles have a primary role of environmental load over mega cities due to in situ presence of air suspended carbon nanoparticles or cytotoxicity [5-6]. The global impact of tribology at socioeconomic domain is expressed as 20% of global energy consumption goes to overcome friction at mechanical rubbing interface, 18-40% can be saved by inclusion of innovative technology, correspond to 8.7% of global chemical energy consumption or fuel oxidation, and attributes to 1.4% of the global economy [7]. The fourth-generation industrial revolution is streamlining sustainability for reducing environmental load, IoT, Automation, and qualitative designing or manufacturing of surfaces as per the global requirement. The emerging automobile areas in the world using clean energy is the electric vehicles (EV) market for market size of EVs doubled in 2021 from

the previous year to a market size of 6.6 million whereas in calendar year 2012 only 0.12 million electric cars roll down globally [8]. The electric vehicles (EVs) in 2021 consumed ~55 TWh of electricity, 10% of can be related to two-wheelers, and more than 40 Mt of CO₂ equivalent of GHG emissions saved by the designing or manufacturing of socioeconomic EVs [9]. FAME-II or Faster Adoption and Manufacturing of Electric vehicles is implemented by the Government of India to in April, 2019 to encourage the modulation to electric mobility from conventional IC engines with a political agenda to reduce carbon emissions in streamline line with the COP 21 agreement [10]. Transport is the primary contributor of pollution, public transportation accounts for 90% of transport, and the transition to sustainable & clean mobility for rolling down of JBM electric buses [11]. The mechanical performance for a EV driveline lubricant depends on durability, wear protection, copper corrosion resistance to protect electric motor windings, electrical conductivity, material compatibility or coating protection, and oxidation resistance in designing of energy efficient electric vehicles (EVs) for reducing environmental reactions [12]. The sustainability from the mechanochemical reactions of fuel oxidation of IC engines in mobility, environment pollution, and congestion are the global challenge leading cities of India.

3. A Virtual Study

Tribology 4.0 is initiated at sliding interface of man-machine due to 21st century technological and scientific revolution such as IoT, electroadhesion, sustainability, and Socioeconomy. The tactile friction is vast in urban cities of India at android phones, digital shopping, and virtual platforms across digital revolution. The biological and electromechanical substrates have a tribology potential for expressing electroadhesion as per the requirement of socioeconomic parameters. The slipping real area of contact of biological interface at man and machine tribological domain provide a digital information due to the mechanoreceptor. The conservation of energy principle is viable for upgradation of performance indicators due to lowering of carbon footprints from personal domain as a function of economy. Adhesion, friction, lubrication, and wear of rubbing biomechanical interfaces create a tribological load for advancement of sustainability at materials-energy spectrum. Author expressed a personal viewpoint for a hypothetical assumption of human as a heat engine in delivering work by safeguarding a sink zone for rational mechanical efficiency. Sustainability of work-life fulcrum is strongly influenced by sink reservoir of a virtual heat engine in urban anthropogenic environment. A fundamental illustration of a materials and energy balance for explaining adhesion, lubrication, friction, wear have been interpreted from an optimum ratio of mechanical

work to the fuel energy released based on 2nd law of thermodynamics by assuming human body as a heat engine.

4. Conclusions

Automobiles vehicles for urban mobility based on petroleum fuel IC engines evolved cytotoxic environmental load due electroadhesion of air suspended hazardous particulate matter. Political regulations are safeguarding carbon neutrality in a collective effort viz. COP21, SDGs, IPCC, and FAME. The designing and manufacturing of electric vehicles (EVs) by leading automobiles in India have evolved a technical pathway for strengthening science-policy-society domain. Economical production of Lithium-ion batteries is viable in India at sociotechnical frontier. Electric buses reinforced under FAME-II are visible on the roads of NCT Delhi, India for reduction of environment reactions by automobiles of public transport.

Author Contribution

Author wrote the academic content for achievement of performance indicators

Conflict of Interests

None conflict of interests to declare

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